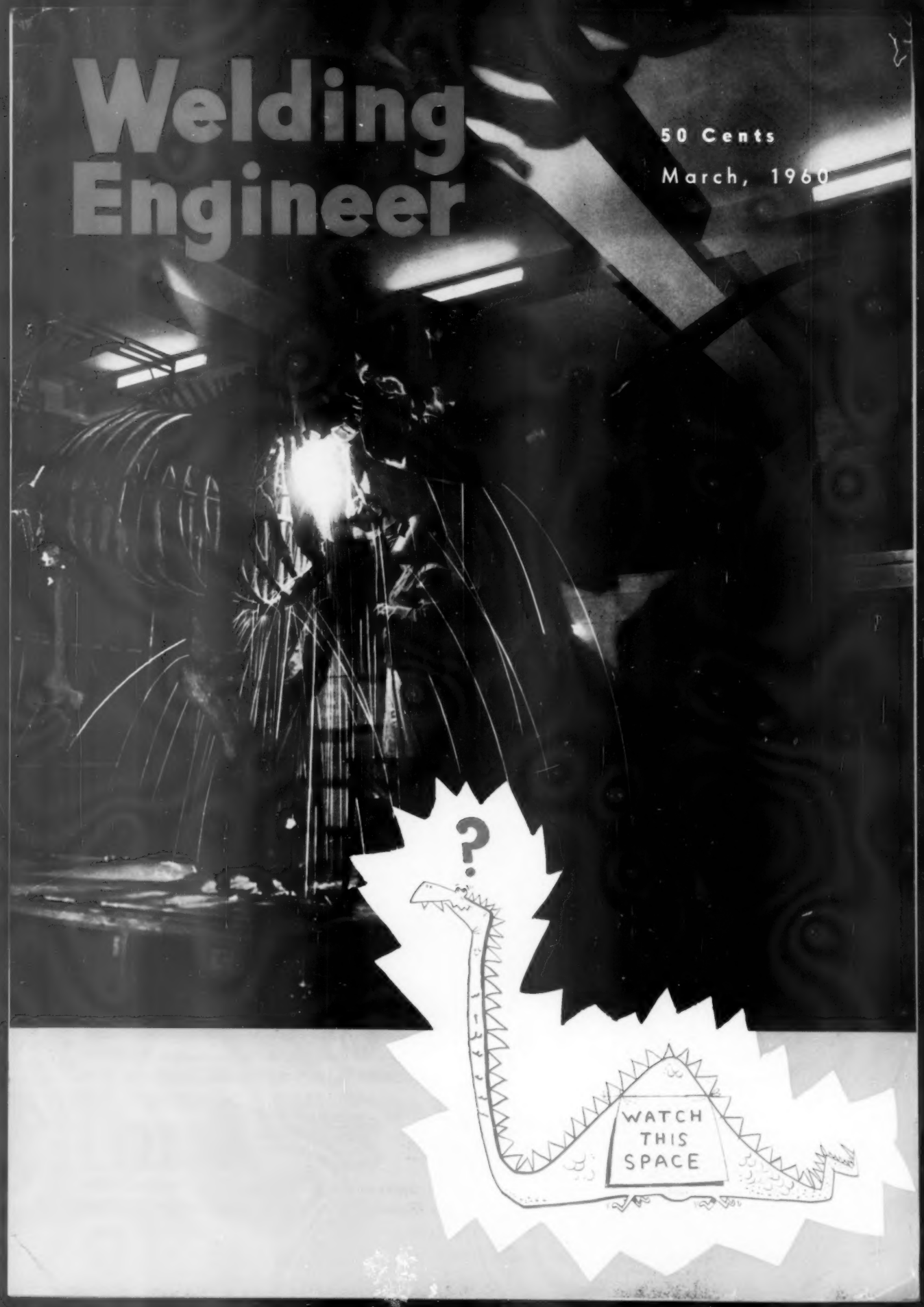
Welding Engineer

50 Cents
March, 1960



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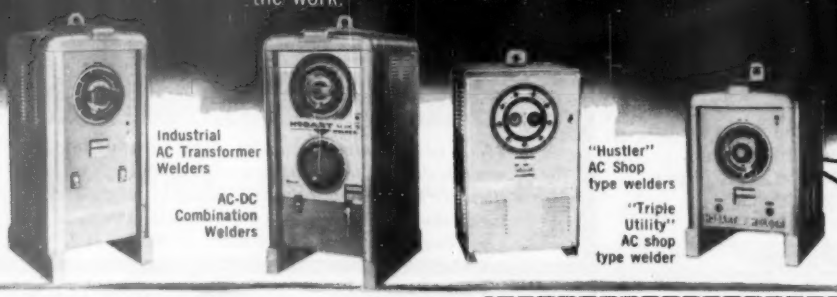

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335-A (E-6011)

- **Excellent for gage material and sheet metal work when used with DC straight polarity.**
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- **Excellent for any welding position.**
- **Easy to use on AC or DC current.**
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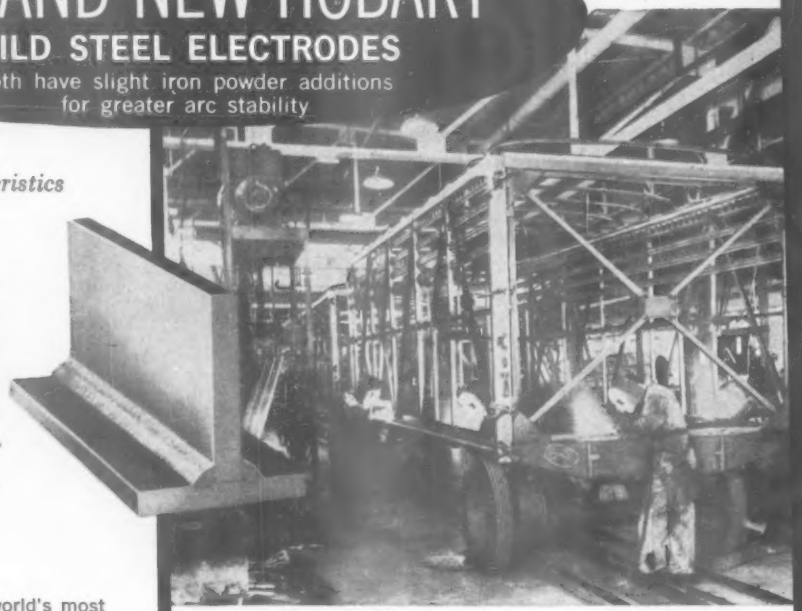

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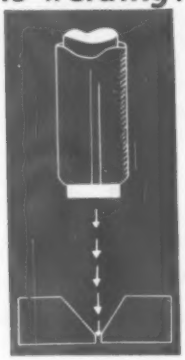
VOL. 45 — No. 3

Welding Engineer

The magazine of joining and severing of materials

This is welding: March, 1960



Cover: Welding helps giant prehistoric mastodon stretch some stiff muscles at Chicago museum. See page 23.

Manufacturer has diversified product line-up 30

This mining equipment company is 83-years-young. It first began welding its products in 1915, and when editor **F. T. Tancula** recently visited the Ohio plant, new positioners, carbon dioxide-Mig units, manipulators and several smaller items had just been added to further facilitate production of the custom-like lines.

The importance of polarity in arc welding 32

Polarity's effect on penetration patterns when fillet welding is usually slighted by design engineers, who also tend toward very liberal dimensioning. The usual result is overwelding. Author **Bela Ronay** discusses the various factors to be considered when choosing between reverse or straight polarity.

★ (For a reprint of this article, circle number 249.)

Dam penstocks rely on submerged-arc welding 34

Continuous steel cylinders contain the rapidly flowing water in a dam setup—and submerged-arc welding puts them together. **E. H. Weil** reports the welding facts on fabrication of these components on Idaho's Brownlee dam. Penstock construction on Montana's Fort Peck dam is also detailed.

Determining strength of fillet welds on angles 37

When making fillet welds on angles, the weld joint must be proportioned properly to reduce internal stresses and strains. Author **Nicholas S. Hodska** gives his method of determining the correct weld size and length for the most economical strength, joint efficiency and margin safety.

★ (For a reprint of this article, circle number 250.)

Producing accurate poke weld fixtures 40

Honeycomb welding demands a tolerance no greater than 0.002 in. to be effective, and standard welding fixtures are costly and difficult to produce if they are to meet this tolerance. **Charles H. Miller** discusses the advantages of this new fixturing method and its production.

Newest electron beam entry is German-made 44

In keeping with its policy of following up the news, **WE** attended the United States debut of the latest entry into the electron beam field, and reports on this soon-to-be-marketed process developed by the Carl Zeiss Foundation.

Also in this issue:

Welded design bridge winners 29
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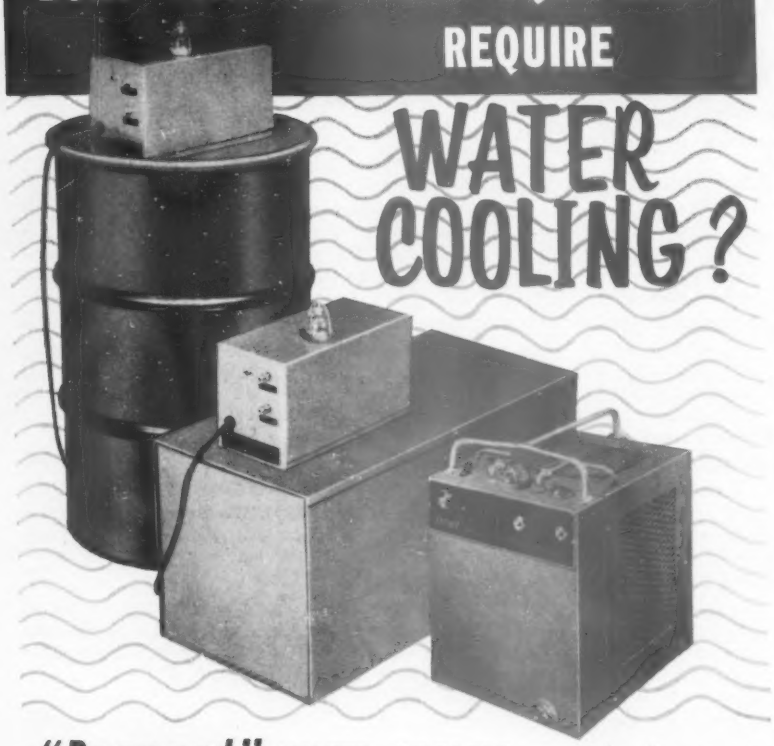
DOES YOUR WELDING EQUIPMENT REQUIRE WATER COOLING?



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NEWS

Cusack elected president of Compressed Gas Assn.

George C. Cusack, executive vice president of Pure Carbonic Co., Div., Air Reduction Co., Inc., New York City, was elected president of the Compressed Gas Association, Inc. at the concluding session of the association's 47th annual meeting held January 18-20 at the Waldorf-Astoria Hotel, New York City.

Other elected officers include D. M. Horner, president of Harrisburg Steel Co., Div., Harsco Corp., first vice president; and Richard S. Passmore, manager, Ammonia Div., Armour Industrial Chemicals Co., second vice president. Franklin R. Fetherston, who has served as secretary-treasurer of the association since 1927, was re-elected to that office.

NEWLY elected officers of the Compressed Gas Association are, from left, George C. Cusack, president; D. M. Horner, first vice president; Richard S. Passmore, second vice president; Franklin R. Fetherston, secretary-treasurer.

Radiography, ultrasonic courses offered

Five-day courses in industrial radiography and ultrasonic inspection are being given by Curtiss-Wright Princeton Division. One was held last month, and another starts March 14.

The courses cover history, theory, application, standards and instrumentation. The ultrasonic testing course has been extended in length from its original three days to five days to provide more time for students to use equipment on realistic problems involving immersion and contact testing techniques.

American Brass to build large corrosion, chemical research center

The American Brass Co., Waterbury, Conn., has revealed plans for the construction of a $1,500,000 research center. Ground will be broken in early summer, and completion is scheduled for 1961.

Metallurgical and corrosion and chemical laboratories will be included in the center, as well as equipment for experimental fabrication of new products. Also incorporated will be offices for the company's central technical staff.

"Development of new lines of products and a constant quest for basic knowledge affecting our metals have become of paramount significance," said Richard M. Stewart, firm president. American Brass is a wholly-owned subsidiary of Anaconda Co., New York City.

Eight complete course in better welding methods

Eight men recently received certificates from All-State Welding Institute for completing a course in improved methods of joining and salvaging all base metals.

The men, from such firms as Otis Elevator, Hamilton Standard, and Hudson Laboratories of Columbia University, are George H. Johnson, Dan Zerega, Vincent DiLiberti, Edgar H. Brisson, Norman Belliveau, John J. Mooney Jr., John J. Resi and Arthur Johnson.

COMING EVENTS

APRIL 4-7: 1960 Atomic Exposition, New York Coliseum, New York City.

APRIL 25-29: 41st Annual Convention, AWS, The Biltmore Hotel, Los Angeles.

APRIL 26-28: AWS Exposition, Great Western Exhibit Center, Los Angeles.

MAY 5-7: NWSA 16th Annual National Convention, Palmer House, Chicago.

MAY 25-26: Symposium on Refractory Metals and Alloys, McGregor Center, Wayne State University, Detroit.

OCT. 17-21: 48th Annual Safety Congress, Chicago.

Craft proves durable

GLIDING at a top speed of 20 knots, this 45-ft aluminum hulled catamaran has completed two years of extensive testing. No structural weaknesses or weld failures were revealed, even when the boat was rammed with a force of 500,000 ft-lb by a tug. Forster Shipbuilding Co., Inc., Terminal Island, Cal., used the Mig process in building the craft. Kaiser Aluminum supplied the plate.

400 displays held at maintenance show

Twenty thousand engineers and executives from 30 nations converged on Philadelphia late in January to attend the 11th Plant Maintenance and Engineering Show.

The four day show saw 400 exhibitors displaying equipment and ornament valued at $7,500,000. Some 10,000 products were on view, varying from high-powered floor sweepers to models of prefabricated buildings for use as shelters during exploration of the moon.

Other products and ideas at the show included an automatic fire detector that "sees" a fire 100 feet away, glass smokestacks for factories, small portable heating units capable of heating huge areas, small indoor fire engines, and truck-mounted air conditioning units to cool shopping center sidewalks.

Robotron introduces new welding power system

A new electronic control and power system for resistance welding aimed at using considerably reduced power compared to that required in conventional systems has been released for field testing by Robotron Corp., Detroit.

Resistance welding jobs formerly demanding very large welding transformers have been done with the new control principle using transformers of only a fraction the size usually required, according to the firm.

Called "spike power" welding, the process is a result of five years of research. Robotron claims welding penetration and fusion are almost instantaneous, take less time, less power and generate far less heat.

New officers chosen at AIRPS convention

Newly elected officers of the Associated Independent Rebuilders and Parts Suppliers for 1959-60 are Samuel B. Maximon, president; William P. Hilts, vice president; Robert J. Weber, secretary; and Clarence A. Goss, treasurer. Benjamin L. Finn is executive secretary.

More than 150 persons attended the organization's recent convention at Roanoke, Va., to participate in the exhibits, workshops, lectures, and panel discussions held there. Guest speakers at the sessions included Paul Slone, executive secretary of the National Association of Dental Laboratories; also, an official of the loan service of the Federal Small Business Administration.

Five regional meetings have been planned by AIRPS, to accommodate those members who cannot come to the association's annual meeting Oct. 23-25 at St. Louis. These meetings will be held at: Atlanta, Feb. 13; Dallas, April 9; San Francisco, May 21; Chicago, July 16; and Philadelphia, August 20.

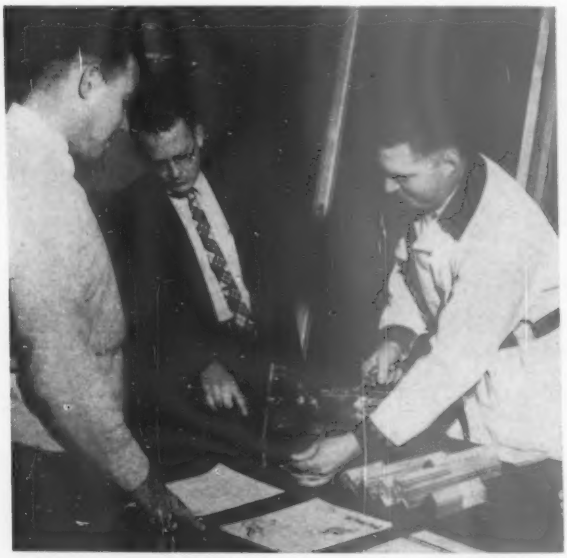
Titan turning out rod on west coast

Production of a complete line of industry-vital bronze welding rod is taking place at a new manufacturing facility of Titan Mfg. Co., Div., Cerro de Pasco Corp., Newark, Calif.

Manufacture of the rod has increased gradually over recent months following initial "pilot" operations, and follows in variety and quality the rod made for many years at Titan's national headquarters at Bellefonte, Pa., according to the company.

As the first step in production of the rods, component metals are precisely weighed before melting and alloying in electric induction furnaces. Twice during the melting process, the alloys undergo a special "deoxidizing" treatment to insure removal of contaminating gases.

In the furnaces, the metals are melted and alloyed under precisely controlled time and temperature conditions. After pouring into water-cooled, copper-lined molds at the exact temperature required for the specific alloys, the ingots are allowed to cool. Later sawed into smaller sections, they are passed by a conveyor to electric induction heaters, where they are automatically reheated to extrusion temperature.



DIFFICULT dissimilar welding job was one of the highlights of a show held recently by Chase Brass & Copper Co. in its Maspeth, N. Y., warehouse. Here a representative of Aro Spot Welders, Long Island City, N. Y., spot welds a galvanized steel bracket to new soft aluminum unveiled by Chase to sheet-metal fabricators.

BRONZE welding rod is near end of production cycle at Newark, Calif., plant of Titan Metal Mfg. Co. Fed from coils, rod is automatically stamped, straightened, and cut to length. Manufacture of the rod has increased gradually over recent months following initial "pilot" operations, according to firm.

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In October, 1954, Alloy Rods Company "scooped" the welding electrode industry. For the first time an all position—iron powder—low hydrogen electrode was made available to the American welding industry. Immediate acceptance by the nation's most prominent and discerning fabricators proved Atom•Arc to be the most outstanding new electrode development on the American market and for nearly one and one-half years Atom•Arc was in the enviable position of being the only electrode of this type available. Due to consistent high quality, Atom•Arc has remained the leader in its field and because of this leadership, is the most imitated electrode in America.

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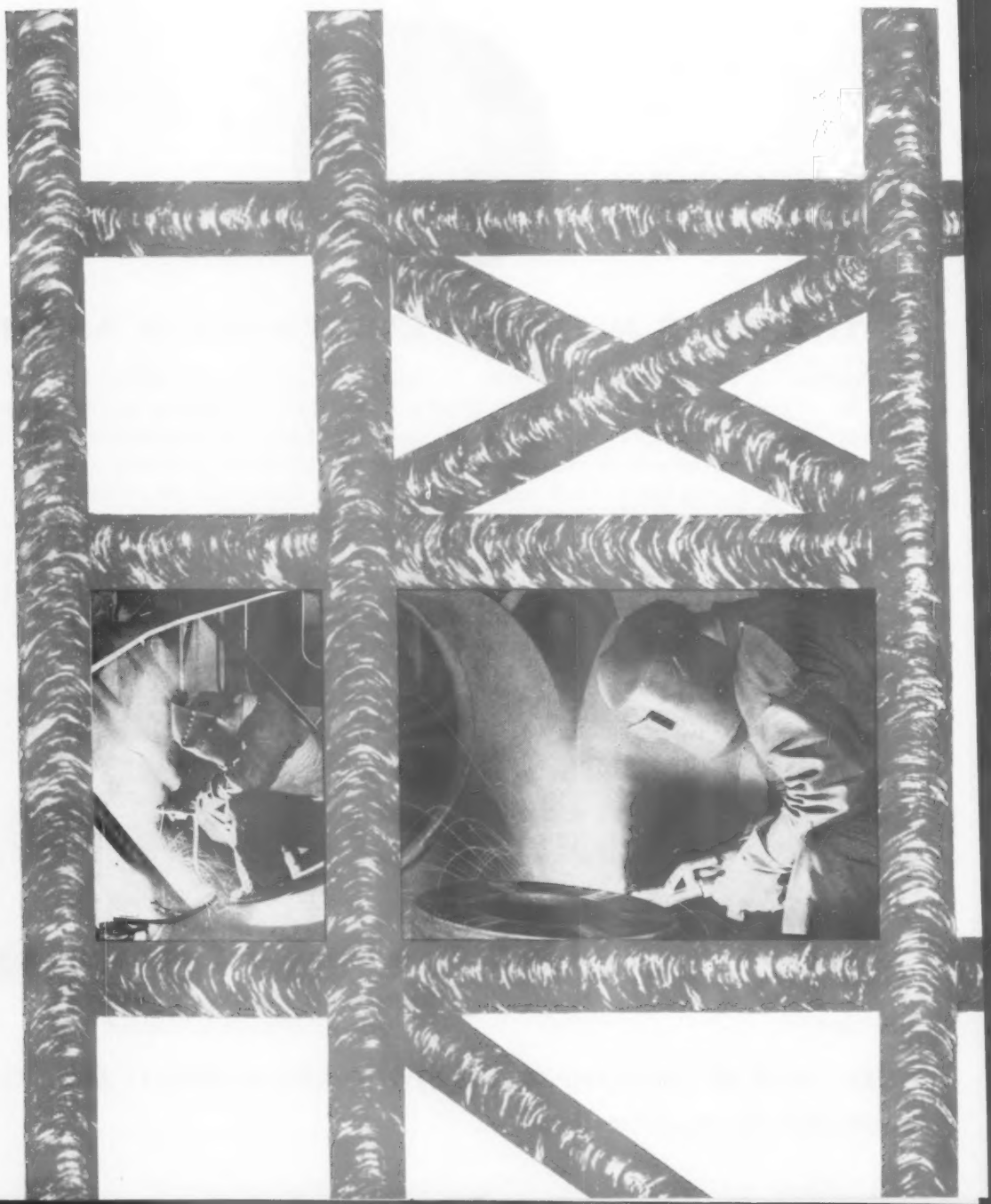

faster welding, instant restrike, hot or cold

Check your nearest franchised Westinghouse welding distributor about the new ZIP-10, one of a series of iron powder-coated electrodes . . . as well as the other electrodes in the complete Westinghouse line. Write Westinghouse Electric Corporation, Welding Department, 4454 Genesee Street, Buffalo 5, New York, for a pocket-sized electrode selector booklet.

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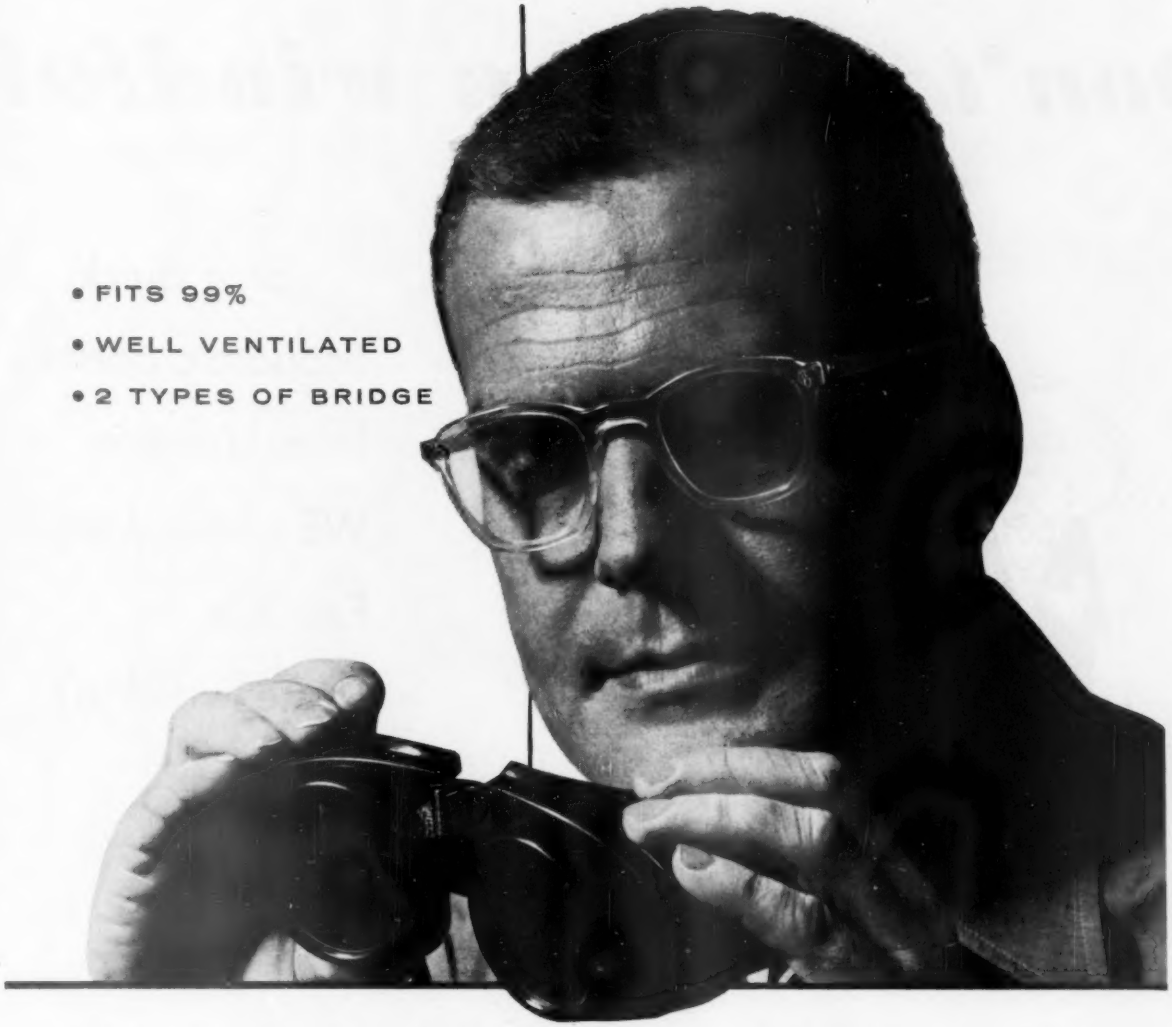

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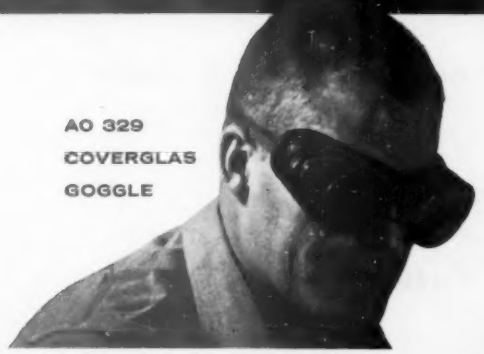

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- Accommodates every type of personal glasses.
- 50mm. round lenses (Filterweld Nos. 3, 4, 5 and 6 shades standard).
- Adjustable leather bridge. Also available with rigid bar bridge as 329B.
- Opaque black, cellulose acetate eyecups.
- Companion chippers' model (325) has direct ventilation and clear Super Armorplate lenses.
- Your nearest AO Safety Products Representative can supply you.

Be Safe For Sure . . . With AO SURE-GUARD Goggles

Don't expect a windfall

. . . or a quick economic boom from space in WE's Mid-June Fact File. These we don't promise.

But <u>do</u> expect . . .

- —high focus concentration: 80% of WE's circulation is directed to the 13 most important welding areas.
- —year-round attention from readers using it as a reference.
- —complete listings of manufacturers, trade names, supplies, other vital information.
- • In short, the most effective way to reach the buyers and users of welding equipment.

Closing date: May 20

WELDING ENGINEER

Your March, 1960

Weld World

As WE went to press, these were the industry's latest developments:

. . The Sight Feed Generator Co., West Alexandria, Ohio, has changed its name to Rexarc, Inc. President Carl F. Smith said the change will not affect personnel, policies or products. The Sight Feed name will be retained to designate the division responsible for manufacturing acetylene generators. Rexarc has been the firm's trade name for its submerged-arc equipment, positioners and hardfacing alloys.

. . Amerloy, Inc., is the newest name in the welding alloy field. A division of American Alloys, Inc., also a new organization, Amerloy will manufacture spooled, cut and coiled aluminum, stainless, magnesium, titanium and copper-bearing alloys at its plant at 37650 Sycamore St., Newark, Calif. General sales office is at 840 N. Michigan, Chicago; western sales office at 1214 Meadowbrook Ave., Los Angeles. Officers are E. M. Westendarp, president; Milt Sims, vice president; G.H. Emin, vice president and general sales manager; and Barney David, vice president and western sales manager.

. . Air Reduction Co., Inc., hit a new record in sales last year—$200,603,636, a 14.4% increase over 1958. Net income was $14,850,600.

. . Norton Co., Worcester, Mass., reported its 1959 total sales at almost $151 million, an increase of some $25 million over the previous year.

. . Transportable oxygen unit, weighing 150 lb and measuring 2 ft square produces an unlimited supply of oxygen from the atmosphere and eliminates need for cylinders. Known as "AerOxy-Gen," the device delivers gas at about 5 psi in less than a minute after activation. Wide applications are forecast for welding and cutting and in hospitals—wherever a compact, low-pressure source is required. It's made by Aerojet-General Corp.

. . Significant price reductions on much of its line was announced Feb. 15 by Smith Welding Equipment Corp., Minneapolis. Refined methods and increased production facilities were cited as the price-reducers.

. . Helium search in southwest Saskatchewan, Canada, widens. Ever since discovery last summer of deposit of inert gases—about 2% helium—three firms have acquired permits to explore an area covering about 270,000 acres stretching to the United States border.

. . Aluminum Co. of America has purchased Rea Magnet Wire Co., Inc., with plants at Fort Wayne and Lafayette, Ind.

Mechanized Hard-Facing Saves Money

A 25% saving in rod was realized by mechanizing the hard-facing of this valve disk. Time required to complete operation was cut from 2½ hours to ½ hour.

Now you can hard-face wearing parts on a production basis and *save* . . . with HAYNES Hard-Facing Machines.

The savings come from a number of factors. The mechanized method produces smooth, uniform deposits—fast. The smooth deposit reduces machining time and increases tool life. The uniform deposit cuts down on rejects and speeds production. Less oxygen and acetylene are required per part because the rate of hard-facing is fast and the flames are efficiently directed. Less rod is required because the depth of deposit is closely controlled.

Machines designed and produced by Haynes Stellite Company insure adequate preheat, proper proportioning of the welding flames, and a continuous supply of molten metal. Only a minimum of manual effort is required to turn out high-quality hard-faced parts.

Our field engineers can help you determine what hard-facing jobs in your shop are suitable for mechanization. For full information, write our general sales office in Kokomo, Indiana.

HAYNES
ALLOYS
HAYNES STELLITE COMPANY

Division of
Union Carbide Corporation
Kokomo, Indiana

UNION CARBIDE

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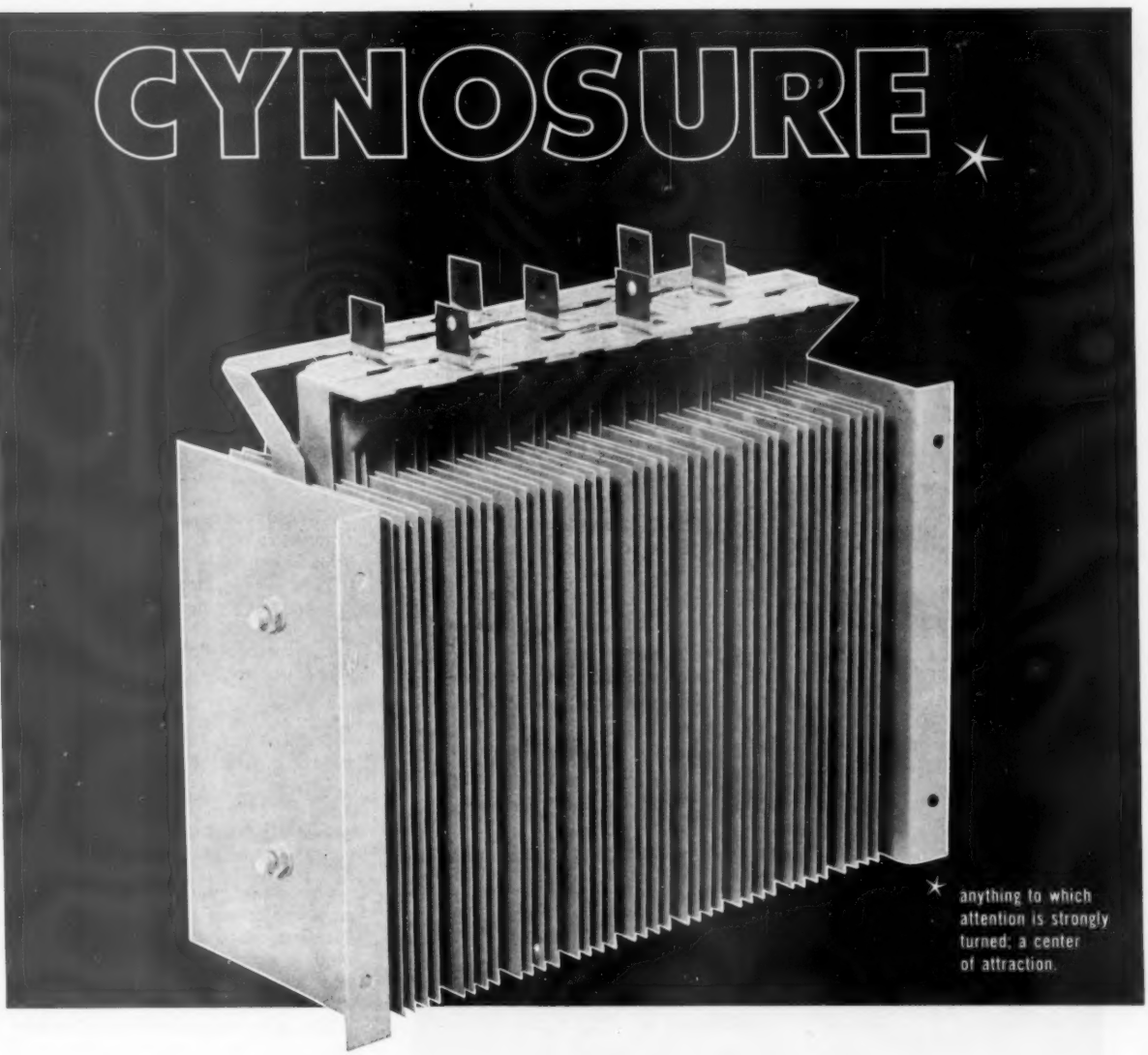
CYNOSURE ★



★ anything to which attention is strongly turned; a center of attraction.

INDEED the center of attraction — The best and longest lasting rectifier ever placed in a welding machine

The mighty heart of the entire line of MILLER GOLD STAR WELDERS is the rectifier stack illustrated above. A MILLER designed, MILLER built and MILLER guaranteed component — one that has proven itself by establishing unprecedented performance records in the only service in which you are interested — arc welding.

We, too, are interested in no other service. For that reason we have built, tested and retested welders utilizing every available rectifier — and every time the answer is still the stack illustrated above.

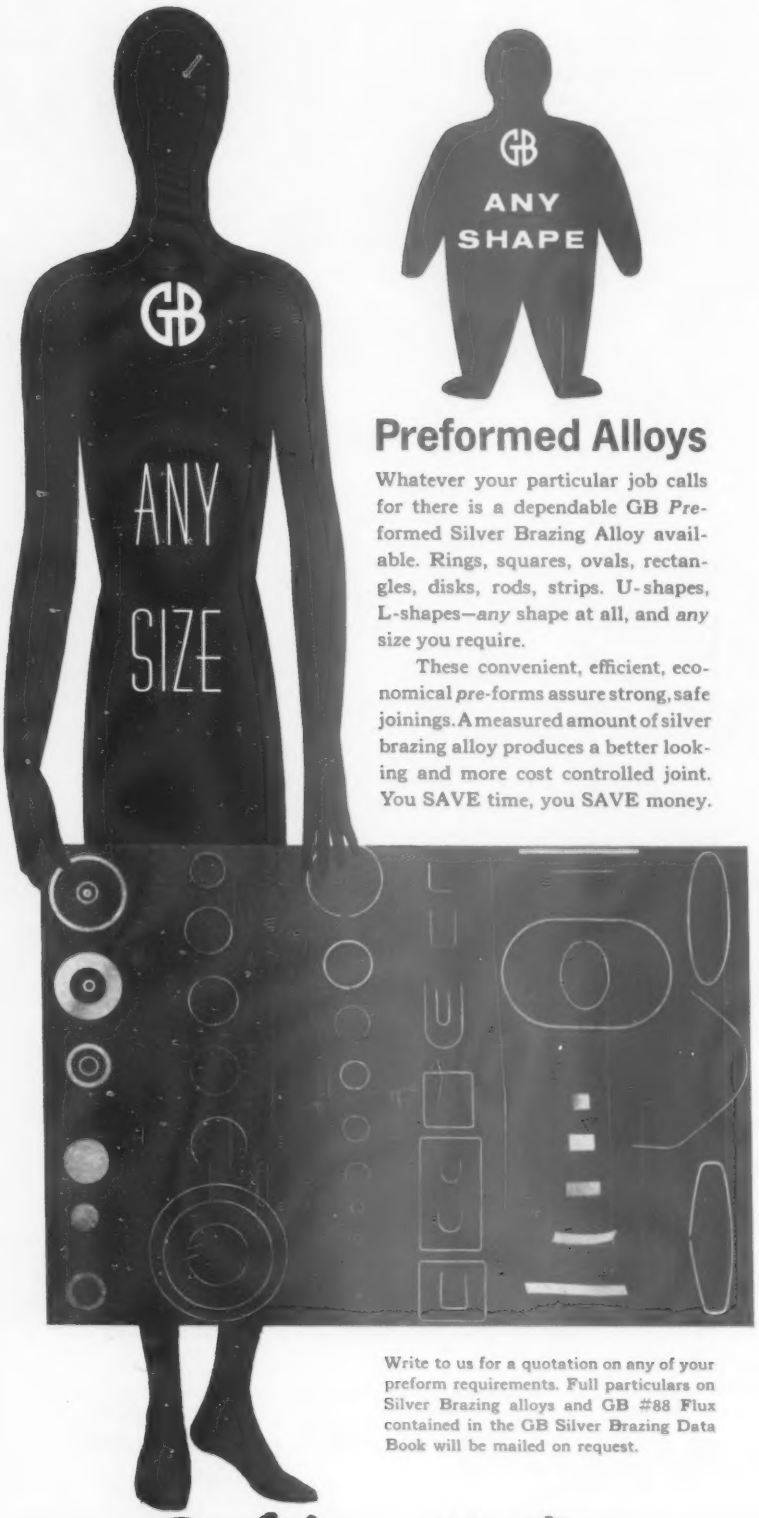
And the "secret" why this rectifier stack is superior to other similar devices? SIMPLE — MILLER research directed only to a better and better rectifier FOR WELDING ONLY — MILLER quality production control directed toward a uniformly high standard product — MILLER production techniques involving extensive automation and electronic process regulation — and MILLER "know how" gained as the largest producer of rectifier type welders.

For a more detailed treatment of this subject, you are invited to ask for a free copy of "A New Performance Record in Rectifiers," written by our director of research, G. K. Willecke.

miller WELDERS

miller Electric Manufacturing Company, Inc. APPLETON, WISCONSIN

EXPORT OFFICE: 250 West 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal



Preformed Alloys

Whatever your particular job calls for there is a dependable GB *Pre*formed Silver Brazing Alloy available. Rings, squares, ovals, rectangles, disks, rods, strips. U-shapes, L-shapes—*any* shape at all, and *any* size you require.

These convenient, efficient, economical *pre*-forms assure strong, safe joinings. A measured amount of silver brazing alloy produces a better looking and more cost controlled joint. You SAVE time, you SAVE money.

Write to us for a quotation on any of your preform requirements. Full particulars on Silver Brazing alloys and GB #88 Flux contained in the GB Silver Brazing Data Book will be mailed on request.

Goldsmith Bros.
DIVISION OF NATIONAL LEAD CO.
900 WEST 18th STREET • CHICAGO 8, ILLINOIS

Letters . . .

Tallest tower

Sir: *Columbia, S. C.*

An article in your January issue described a television tower 1,572-ft high, built by Dresser-Ideco, as the tallest man-made structure in the world. Since erection of this tower, we have designed, fabricated, and erected a tower for WGAN-TV, Portland, Maine, that is 1,619-ft high.

P. M. Proos
Kline Iron & Steel Co.

Strange bedfellows

Sir: *Kansas City, Mo.*

Congratulations on the fine article (February WE) by Fritz M. Hessemer, Allis Chalmers Mfg. Co., York, Pa.

Now all Mr. Hessemer has to do for a subject in the next design award program is to submit an all-welded design for the special flat car for the turbine runner shown on p. 32 . . .

Thomas H. Nicholl
Lincoln Electric Co.

—Sad, but true, Mr. Nicholl; the special flat car pictured is obviously riveted.

Ultrasonic processes

Sir: *Roxbury, Mass.*

I am a student in the welding department at Boston Trade High School. At this time we are studying the newer welding processes and my assignment was "Ultrasonic welding," or "Welding with sound waves."

Will it be possible for you to send me a list of the names and addresses of the manufacturers of this equipment so that I can obtain further information from them?

Robert Mallory

—Information has been forwarded.

Steady reader

Sir: *Clarkston, Mich.*

Received your letter Saturday, have been kind of slow about renewing as I have retired now. Just do a little welding at home. I started reading your *Welding Engineer* back in 1922. Have learned a lot through reading it . . .

Frank Waid

Letters should be addressed to: The Editor, WELDING ENGINEER, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Seeks information

Sir: *Lakewood, Cal.*

I have developed an inexpensive process for welding aluminum to mild steel. Cast iron and most alloy steels can be welded with the same process . . . would you please let me know if there is a process and if it is patented. Also who would be most interested in such a process. I am a regular subscriber to your magazine and consider it the finest publication in the field of welding . . .

Joseph P. Shradeja

More information

Sir: *Gardena, Calif.*

In the November *WE*, we noted with great interest the article on page 80 concerning a silver bearing solder #430. We would appreciate receiving information on this alloy and its method of application . . . and possible sources.

K. O. Stamm
Process Engineer
Minneapolis-Honeywell Regulator Co.

—Mr. Stamm has been referred to All-State Welding Alloys Co., Inc., White Plains, N. Y., maker of the product in question.

Sir: *Woodland Hills, Calif.*

On page five of your December issue . . . there is a short article about metal cutting by electrified salt water. We would appreciate any additional information that you could furnish us or from whom such information may be obtained.

Thor Eilertsen

—We referred Mr. Eilertsen to Anocut Engineering Co., Chicago.

"It's no use . . . the numbers are too small to see what the date is!"

Ranite Hardsurfacing Rods

So economical

by every

MEASURE

RANITE IS PREFERRED BY THE MEN WHO KEEP THE RECORDS

Investigate these facts:

- EXCLUSIVE RANITE METALLIC COATING FORMS MORE WELD METAL—NO SLAG WASTE.
- MORE WORK IS ACCOMPLISHED—WELDERS LIKE TO RUN RANITE.
- RANITE DEPOSITS METAL FASTER—SAVES LABOR.
- SMOOTH, LONG WEARING OVERLAYS EXTEND PARTS LIFE, REDUCES DOWN TIME AND EXPENSE OF ADDITIONAL REPAIRS.
- STORAGE IS NO PROBLEM, COATING CONTAINS MOISTURE REPELLENT —RODS PACKED IN HANDY WOOD BOX.
- FACTORY SERVICE MEN WITH ACCUMULATED YEARS OF EXPERIENCE AVAILABLE FOR CONSULTATION AND SHOP ASSISTANCE.

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WELDERS' NO. 1 CHOICE FOR HARDSURFACING

For the Welding Industry...

EUTECTIC'S NEW NATION-WIDE TRAINING

In celebrating its 20th Anniversary of Service to Industry, EUTECTIC TAKES THE LEAD AGAIN with the establishment of complete weld training facilities in each of its 16 Service and Training Centers from coast-to-coast in the U.S.A. and Canada.

EUTECTIC has always been a leader in offering the finest training to weldors through the Eutectic Welding Institute. Under this ambitious new program, additional thousands of men in industry will have the opportunity to learn the latest metal joining techniques with the Low Heat Input process.

The courses will show how industry after industry is saving money with more efficient maintenance and repair programs using famous EUTECTIC "Low Temperature Welding Alloys"®. They will show how leakproof, strong joints can be obtained at temperatures hundreds of degrees below the melting point of the parent metal... how difficult metal joining problems such as joining extra thin or dissimilar metals can be solved... how metals from Aluminum to Zinc can be welded and repaired with greater ease and speed than ever before.

Courses will consist of intensive one day sessions and

CELEBRATING OUR 20th ANNIVERSARY OF SERVICE TO INDUSTRY

PROGRAM IN 16 MAJOR CITIES

week long Conference Courses. Each group will be limited to fifteen people to assure that everyone gets the fullest opportunity to profit from the latest advances in welding of heavy castings, tool and die repair, joining different metals and materials, general maintenance and repair problems and their job-proven solutions.

In preparing this, America's largest Weldor Training Program, Eutectic demonstration specialists have drawn upon the experiences acquired in the company's fifty years of research and development... upon its twenty-year background as a world-wide organization... upon the job knowledge acquired by its more than 350 specially trained technical representatives in the field. The well known Eutectic Welding Institute in Flushing, will provide guidance and organize these thorough courses.

EUTECTIC WELDING ALLOYS CORPORATION is the originator, patent holder and sole world-wide manufacturer of EUTECTIC "Low Temperature Welding Alloys". These unique products minimize warping, distortion, weld embrittlement, and other damaging effects to metal encountered with common, high heat materials.

® REGISTERED TRADE MARK OF :

EUTECTIC WELDING ALLOYS CORPORATION

40-40 172nd St., FLUSHING 58, NEW YORK

Service and Training Centers in ATLANTA; BOSTON; CHICAGO; COLUMBUS, OHIO; DALLAS; DETROIT; LOS ANGELES; ST. LOUIS; SEATTLE; BERKELEY, CALIF.; HURON, SO. DAKOTA; PHOENIX, ARIZONA.

Warehouses: CANADIAN PLANT AND HEADQUARTERS: MONTREAL DARTMOUTH, N. S., TORONTO AND VANCOUVER

COURSES WILL BE HELD IN THE FOLLOWING LOCATIONS:

ATLANTA; BOSTON; CHICAGO;
COLUMBUS, OHIO; DALLAS;
DETROIT; LOS ANGELES; ST. LOUIS;
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IN CANADA:
MONTREAL, DARTMOUTH, N. S.,
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VISIT OUR BOOTH 118
APRIL 26-27-28 '60
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National Manager
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40-40 172nd Street, Flushing, New York
Dear Sir:
I am interested in:
- ☐ One-day program
- ☐ One week conference course
- ☐ Evening classes
- ☐ Free booklet on EUTECTIC "Low Temperature Welding Alloys" and Fluxes

Name .....
Company .....
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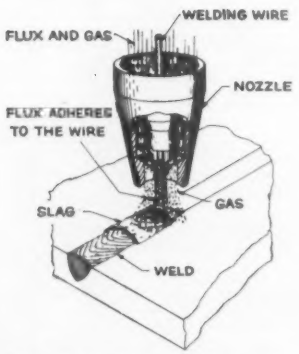
City ..... State .....

NEW CO_2 MAGNETIC FLUX MACHINES

Oil storage tank UNIONARC welded by Ellerbee Brothers, Port Arthur, Texas

...CUT WELDING TIME 62%



Magnetizable flux, carried in stream of CO_2 shielding gas, clings to bare wire fed automatically into weld zone. Flux refines weld metal, prevents contamination, controls contour, lowers cooling rate, and stabilizes arc.

LINDE's *new*, *portable* CO_2 magnetic flux UNIONARC UAM-2 welding machines, used to field-erect three oil storage tanks, paid for themselves in time savings alone . . . depositing as much metal in one pass as coated electrodes did in three. Over 10,000 ft. of welds without a single defect . . . welding man-hours cut from 1850 to 700 . . . cleaning costs cut two-thirds.

UNIONARC welding, fastest manually-operated method for welding steel, uses low-cost carbon dioxide, magnetic flux, and a continuously-fed wire electrode . . . all automatically controlled. No stopping to change electrodes. No plate preparation necessary. X-ray quality welds in all positions. Complete penetration despite normal rust. Negligible spatter. Requires less operator skill than coated electrodes. Deposits 9 to 18 lbs. of weld metal per arc hour (3/32-in. wire, 300 to 500 amperes).

Write for booklet (F-1376) on other cost-saving UNIONARC welding applications: Dept. WE-03, Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. Terms "Linde," "Union Carbide," and "Unionarc" are trade marks of Union Carbide Corporation.

Linde UNION CARBIDE

BETWEEN PASSES

a tribute

On Friday, Jan. 22, the town of Escanaba, Mich., observed a second Thanksgiving. Even the schools were closed for the celebration, in which 16,000 residents of the community played host to several hundred guests from 50 states and Canada.

Throughout the 18-hour schedule the citizens staged a whopping jamboree in honor of Harnischfeger Corp., Milwaukee. Reason behind the celebration dates back 12 years when Harnischfeger chose to locate a welding-equipment plant in an abandoned wood-working factory in Escanaba. A year later, the firm built a new plant to house production facilities for truck cranes and excavators. Now, the two plants have more than 1,000 workers and constitute the community's largest industrial payroll.

The date was chosen to make it possible for P&H dealers, many of whom were attending an equipment show in Chicago, to be present. A special 11-car train carried them and P&H executives from Milwaukee to Escanaba.

The thanksgiving celebration was appropriately dubbed "Big Ole's Outing," after the lengendary blacksmith who worked for the fabulous North Woods hero, Paul Bunyan. Harnischfeger symbolizes "Big Ole" in the area's transition from a declining lumbering economy to a thriving metal-working city.

"our" wine tanker

In mid-February, news about the plight of the *SS Angelo Petri*, which ran into trouble off the West Coast, was received with more than casual interest at *WE*'s offices. For the wine tanker, which later had to be towed into port after most of its crew had been removed by helicopter, was the subject of a comprehensive article published in April, 1958. Described were the welding procedures used to build the cargo tanks, pumps, pipelines, etc. For the most part, these are fabricated from type 316 stainless-clad materials.

On the cover . . . The ages meet

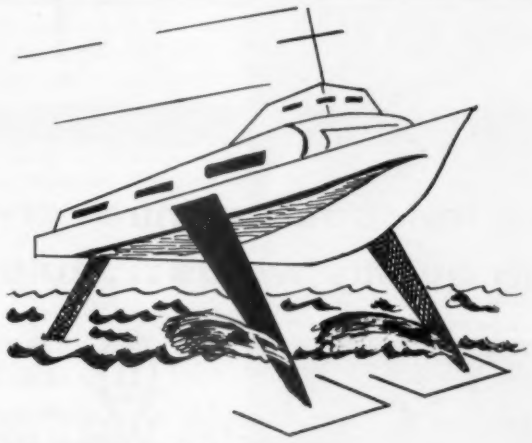
Two ages, the prehistoric and pre-space, met briefly at Chicago's Natural History Museum during a recent restoration.

In the cover photograph of this issue, museum preparator Ronald Lambert is welding a new steel frame for a giant mastodon, an animal which lived during the Pleistocene or glacial era from 10,000 to 1,000,000 years ago.

Welding on the mild steel flat stock, half-rounds and 1¾-in.-diameter piping comprising the frame was done with a 3/32-in.-diameter E6014 iron-powder electrode using 80 amp, 22 volts, a-c.

The revitalizing operation was also accomplished on three other fossil animals from the same era —the great ground sloth, Irish giant deer and northern mammoth.

The new steel supports are replacing old ones which were beginning to show wear and tear after several years of exhibition on the museum's second floor. In addition to generally strengthening and refurbishing the skeletons, the giant fossils are getting a chance to stretch some stiff muscles by changing their positions from poses held since original mounting—in the case of the great ground sloth, since the late 1920's.



ARTIST's conception of hydrofoil ship.

the flying American

Richard Wagner's "Flying Dutchman" was a ghost ship, but the U. S. Maritime Administration's 80-ton, 80-knot test vehicle will be made of sturdier stuff—inert gas welded 5456 aluminum alloy.

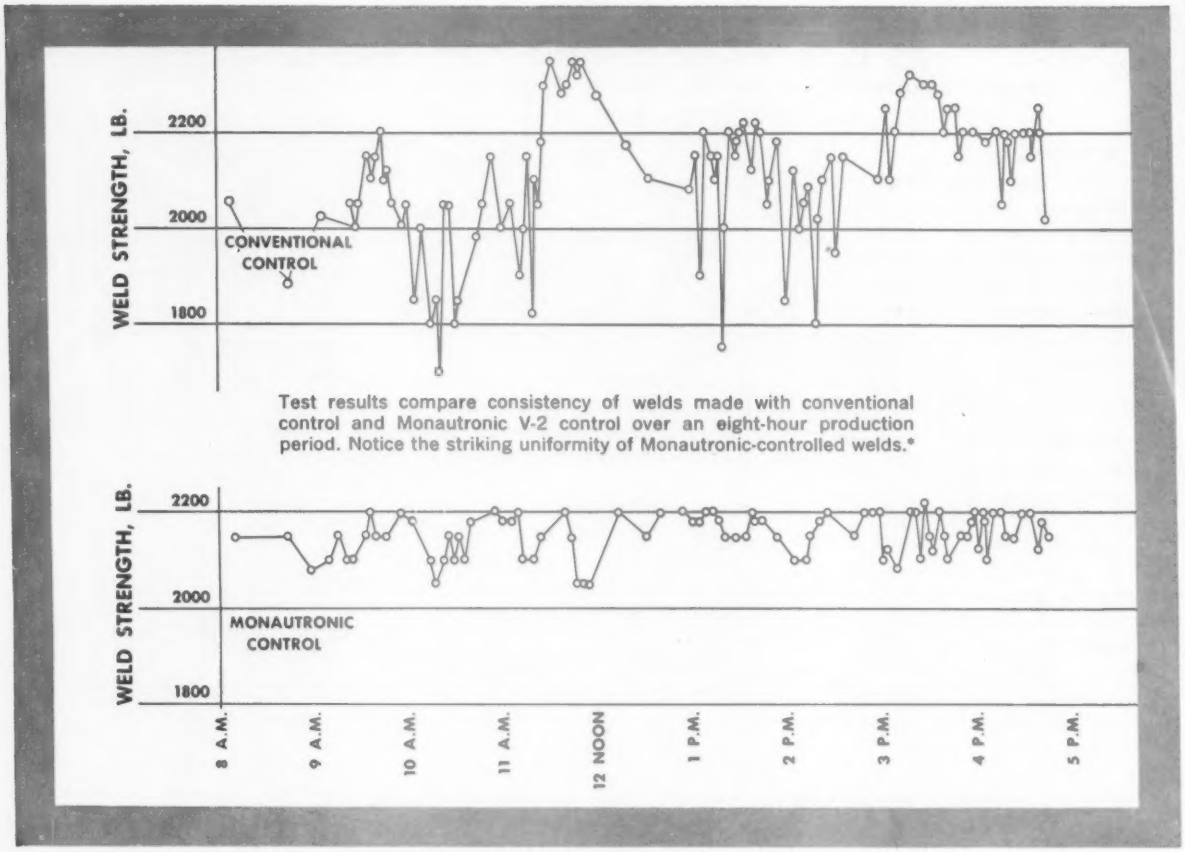
This ship will "fly" a good five feet above the waves through use of small wing-like structures called hydrofoils.

The most promising hydrofoil material, according to Grumman Aircraft Engineering Corp. which is fabricating the ship, is 17-7 stainless steel. This material, or a weldable titanium, will be used on the main hydrofoils.

Basically, the hydrofoil works on the same principle as the airplane wing, *i.e.*, downward pressure of water on the hydrofoil top decreases and upward pressure on the bottom increases. As the ship picks up speed, the gap between pressures widens until it is sufficient to overcome gravity and lift the hull clear of the water.

Lifting the hull eliminates "wave-making resistance" and thus increases the ship's possible speed.

"It's taken 40 years to increase the speed of ships by 10 knots and now almost overnight we can triple their speed. That's pretty revolutionary," says one company spokesman.



Test results compare consistency of welds made with conventional control and Monautronic V-2 control over an eight-hour production period. Notice the striking uniformity of Monautronic-controlled welds.*

new feedback control gives you consistently high quality welds . . . automatically

Monautronic V-2 welding control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

The new *Monautronic V-2* welding control makes use of the latest advances in electronic computing to overcome automatically such obstacles to weld quality as line voltage fluctuation, electrode wear, variations in electrode tip force, surface finish and shunting.

The control compensates for undesirable variations usually encountered in resistance welding by maintaining voltage across a weld at a constant value. This constraint of voltage amounts to constraint of final weld temperatures, and such temperature control assures uniform production of high quality welds.

Any metal that can be resistance welded can be welded better with the Monautronic V-2 than with any other control on the market.

For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

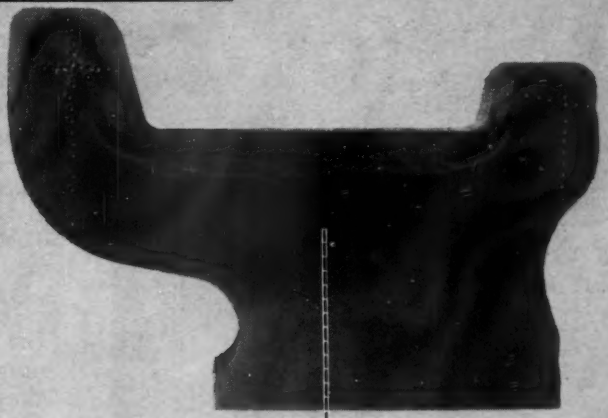
*Case study upon request.

2450 Hunting Park Ave. Philadelphia 32, Pa. ■ 12141 Charlevoix Ave. Detroit 14, Mich. ■ 3050 East 11th St. Los Angeles 23, Cal.

ELECTRONIC Budd CONTROLS

Page Welding Wire

CUTS COSTS FOR TRACK SERVICE COMPANY...



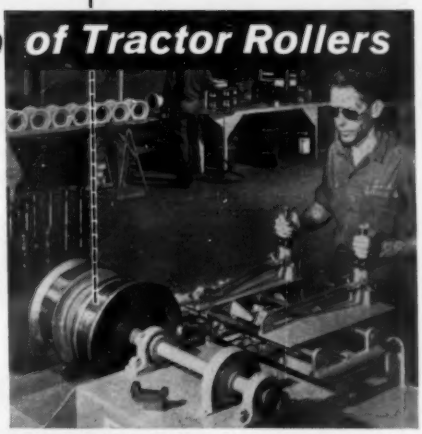
Provides Fast, Economical Build-up of Tractor Rollers

• Two PAGE welding wires have helped Track Service Company of Oklahoma City develop a new method of building up the roller bearings and flanges of tractor rollers. As seen in the section of a flange above, the finished build-up has a smooth machine finish with uniform Rockwell hardness.

The running surface, or bearing, is built up by automatic welding with PAGE analysis A-S-6150—the flanges with A-S-65. Both of these welding wires are machineable as welded, making it easy to machine the welded roller to finished dimensions. At this point, the Rockwell hardness of the flange is C-25, with a hardness on the running surface of C-40/50.

The flanges are then heated to 1500°F and immediately water-quenched, giving a non-spalling surface of about Rockwell C-55 and shading down to Rockwell C-40 at the base metal.

This build-up method is fast—and far less costly than the usual tubular alloys. It's also a good example of the versatility afforded by the wide selection of PAGE welding wires.



Flame hardening of flanges is done on this machine designed by Track Service Company. Top illustration shows cross-section of hardened flange.

Let PAGE Help Solve Your Welding Problems

These Folders can help you

Write for:

Folder DH-402-C Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

When you bring your welding problems to PAGE, you get the benefit of over half a century of wire drawing experience and leadership in metallurgical research. Leadership evidenced by the industry's widest range of analyses —33 grades designed to do an endless variety of welding jobs. Let PAGE help you improve your quality and lower your costs by furnishing the right wire for your job.

PAGE wire packaging is designed to give you the utmost in convenient storage and handling, whether you require a 1# spool or a 1200# payoff-pallet. Prompt delivery is assured from a coast-to-coast network of PAGE distributors backed up by strategically located PAGE warehouses.

You will find it is "good business" to bring your problems to PAGE.

ACCO

PAGE WELDING WIRE

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.

*Indicates *PAGE* warehouse stocks

PAGE—THE SOURCE FOR ANSWERS TO WELDING PROBLEMS

New, high-tensile steels require special care when welding.

Submerged arc welding gives the most reliable performance with T-1, but . . . fully automatic equipment is often impractical for one-of-a-kind jobs like fabrication of a 28 cu. yd. bucket.

That's why Peabody Coal Company used a "Mechanized Squirt Welder" and Lincoln alloy fluxes.

The ML-3 lets the operator guide the automatic welder by hand. Alloy fluxes, specially mixed for welding T-1 steel, provide exact metallurgical control of weld properties.

Mechanized "Squirt" simplifies T-1 steel fabrication...

RESULT: Peabody Coal Company welded the T-1 steel at speeds up to four-times faster than manually. These welds made with special Lincoln alloy flux and L-61 electrode were perfect in every respect.

For complete details on the ML-3 and alloy fluxes write to:

LINCOLN ...USA

THE LINCOLN ELECTRIC COMPANY
Dept. 1430 • Cleveland 17, Ohio

world's leading manufacturer of arc welders and electrodes, ac motors and battery chargers

MARCH, 1960

Welding Engineer

ESTABLISHED 1916

Another price casualty

LAST MONTH on the *Weld World* page, *WE* reported that a 30 year manufacturer of mild steel electrodes was ceasing production of that product. Why did this company throw in the towel?

The firm was making satisfactory electrodes in larger quantities than at any time in its history—but there was a small loss on every pound of electrodes manufactured.

Electrode pricing, in many ways, has been excellent. They are priced much lower than 30 years ago; those coated with expensive ingredients often cost less than similar bare wire straightened and then cut.

But the question remains: are they priced too low?

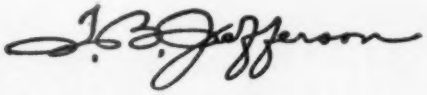
In welding, electrode cost is the least expensive factor. Yet the job this deposited weld metal must perform can often be most critical. It must have high quality because it is melted in place by expensive help.

So each pound of electrodes selling for 14 cents or more represents metal costing $2 per pound and upward in its deposited form.

Electrode price should include a profit to the manufacturer, with enough left over for research to improve quality. What would happen if prices were increased 50%? The question is moot.

But we feel certain the manufacturer mentioned above would not have ceased operation. We also feel certain there would be more money for research which might materially improve our already highly developed electrodes, resulting in more use of welding.

Possibly the cost of deposited weld metal would increase 5 to 7%, not enough to have any effect on the amount of welding being used. In fact, consumers would be willing to take such an increase if they knew it would result in a product that might reduce their overall cost of weldment fabrication.



You get VICTOR QUALITY thru-out this package

We've assembled the Super-Range unit for the man who wants a first-class, complete outfit, ready to handle a full range of shop work—welding, cutting, heating, brazing, soldering. Everything needed to go right to work is included.

Every item listed is Victor's standard, top-quality apparatus . . . and you get the complete outfit for only $99.00. Order from your Victor dealer now.

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Two Victor single-stage safety regulators,
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TOP award in class II bridge design went to Louie Morris Memorial bridge in Hartwell, Ga. Flange to webs, and stiffeners to webs were fillet welded while shop splices of flange and web were butt welded. Transverse welds are radiographically inspected; all others were inspected visually. A continuous ¼-in. weld was used from web to flange for sealing against corrosion.

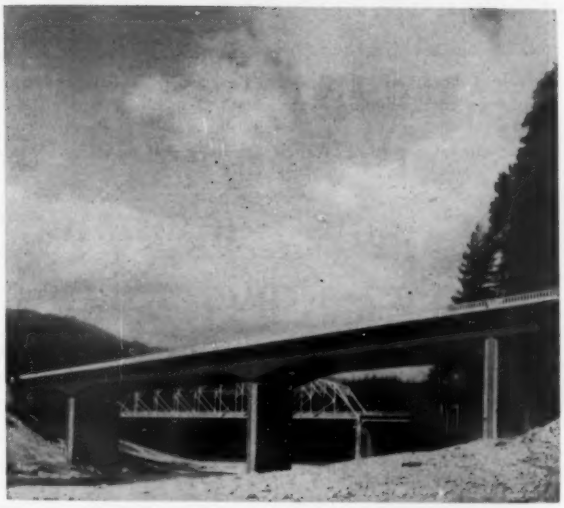
Bridge design winners make use of welding

THE MOST BEAUTIFUL bridges opened to traffic during 1958 were announced recently by the American Institute of Steel Construction—and three of these bridges owe their existence to welding.

A total of 13 bridges in 11 states from 104 entries, the largest number ever submitted, were selected for the awards and honorable mentions in the institute's 31st annual aesthetic bridge competition.

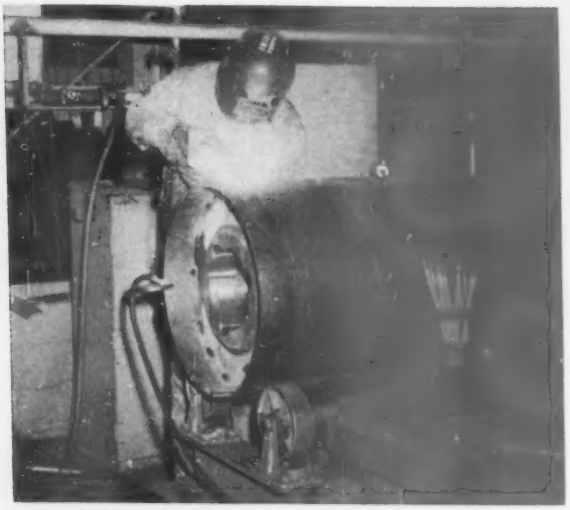
Entries were grouped into three classifications: those with spans of 400 ft or more; those with spans under 400 ft, costing more than $500,000; and those with spans under 400 ft and costing less than $500,000.

The welded bridges shown on this page took a top award and first honorable mention in class II, and an honorable mention in class III.

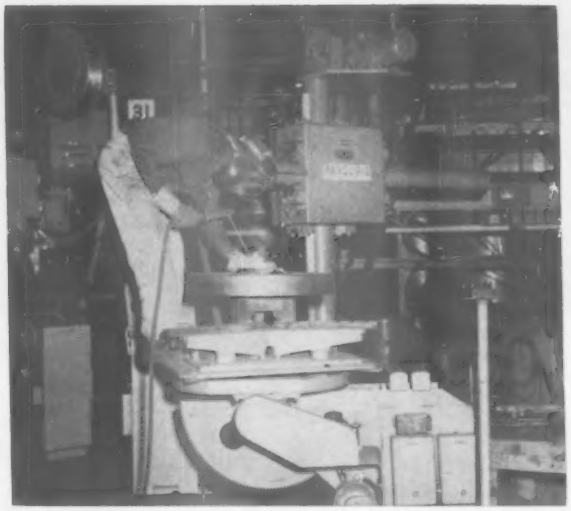


FIRST honorable mention in class II was given to the South Fork Eel bridge at Dyerville, Calif. Complicated and expensive flange and web connections were avoided by welding all field splices. Butt welds join both the same and different thicknesses of flange, as well as the same and different thicknesses of web. Fillet welds joined flanges to web, stiffeners to web and bracing connections to the girders.

AN honorable mention in class III was taken by the Marsh Road Over-crossing one mile south of Redwood City Limits, Calif. Girders and cap are of all-welded design. All welding was done in the shop and all fillet welding on the griders was done in a horizontal position using automatic or semiautomatic equipment. Radiographic inspection amounted to 100% of all flange tension welds, and approximately 50% of compression welds.



DRUM (above, left) for welded steel pulley is having sections joined by carbon-dioxide Mig welding. Operator is using 1/16-in. mild steel wire at 200 amp, 24 volts, one pass. Gas flow is 30 cfh. Power source: m-g (d-c). Weldor (above, right) makes tack welds, joining hub to spur gear prior to automatic submerged-arc welding. On automatic set-up, a four-pass operation is needed to make ¾-in. fillet welds on either side of the gear. Copper-coated, 5/32-in. mild steel wire (60,000 psi) is used at 700 amp, 34 volts.



This mining equipment manufacturer handles a diversified product line-up

by F. T. Tancula

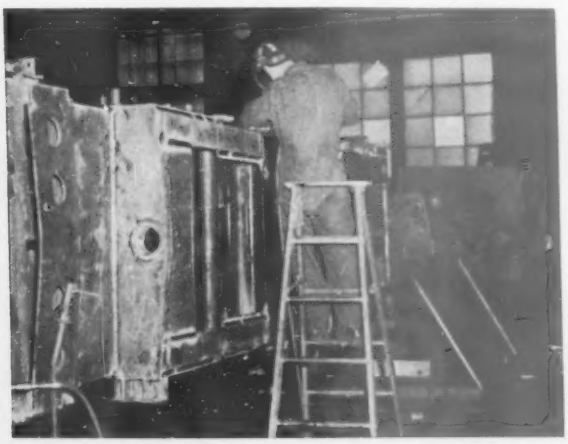
FOUNDED IN 1877, The Jeffrey Mfg. Co., claims its Columbus, Ohio, plant is the largest of its kind in the world—manufacturing mining, processing and conveying equipment, chains, power transmission machinery and related apparatus.

The firm has been welding many of its products since about 1915 and a Jeffrey spokesman credited the process with playing an important role in the firm's development since that time. This is especially true of its mining machinery.

The three-bay welding department (a part of Jeffrey's structural division) employs about 135 weldors who perform their skills on a variety of products. In fact, about 10% of the output in this shop is outside contract work for other manufacturers.

In recent months, Jeffrey's move to automate and modernize its welding shop has hit full stride. Added have been several new positioners (the largest, a 16,000-lb capacity unit built by Harnischfeger Corp.), a new semiautomatic carbon-dioxide welding setup with controls, an automatic manipulator and some smaller items.

Because the firm's product line is so diversified, the welding shops are called upon to join just about any metal imaginable—with the exception of the refractory metals. Jalloy, T-1, A-R and other alloy steels are familiar to all Jeffrey weldors, although from 50 to 60% of the



COMBINATION a-c/d-c power sources are used at this station, where a frame for a mine shuttle car is being fabricated. Electrode is E6024, an iron-powder type that can be used on either a-c or d-c.

JIB crane in background is used to position this center section on the gathering head of a coal-mine loading machine. A low-hydrogen electrode joins the A-R steel; power source is d-c rectifier.

welding is accomplished on mild steel.

When *WE* visited the Columbus facility, monthly consumption of electrodes was estimated to be 20,000 lb.

The A-R steels are used because of their resistance to abrasion—a prime requisite for mining equipment. A typical weld problem that faced Jeffrey was the joining of these A-R steels to mild steel.

The solution, according to Welding Superintendent Roy Mount: lay a stringer bead with low-hydrogen electrode as a form of pre-heat, then lay subsequent passes with mild-steel electrodes. But the welding must be rapid, as beads should be laid while earlier passes are still hot.

The three welding bays contain about 80 welding machines, including two 1,500 amp d-c motor generators.

Custom-built products are the regular output of the structural division, so in essence, the welding department is a huge job shop. This type of operation naturally presents greater scheduling problems than does an assembly-line production set-up. For more on Jeffrey's scheduling, see the boxed story below.

. . . and the system that makes it work

WORK SCHEDULES always have been a problem—probably since the first attempt at human endeavor. And when you're marketing more than one product, the problem is that much more acute.

Jeffrey Mfg. Co., Columbus, Ohio, has inaugurated a system for scheduling welding and cutting operations that promises to achieve what every efficient management continually seeks: economies.

Its weldment shop (consisting of three departments) uses a plan originally devised by the production control department. But Superintendent Roy Mount says his staff has added some refinements, which are helping lick the scheduling bugaboo.

The work areas in the three-bay weld shop are designated by number, and these numbers are duplicated on a dispatch board in the shop office. The board also includes operator's name and number.

But the scheduling starts long before the posting of the work assignment. It begins in the stock receiving area where all components to be fabricated into a weldment or sub-assembly are channeled from other plant departments or receiving areas. The stock man has an assembly material sheet which lists all these components. As they are received by him, he places them on a skid. When all units listed on his assembly sheet have been received, he puts a "Go" card on the skid.

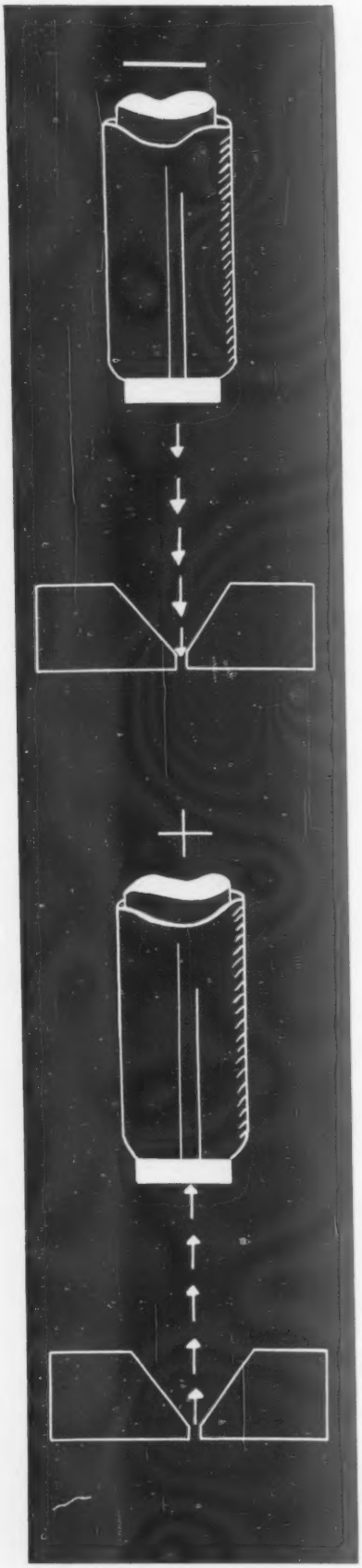
(The jigs or fixtures and other tools needed in production are also enumerated on the sheet.)

This gives a lift-truck operator the signal to take the skid to one of the 67 work areas. Meanwhile, the stock clerk has turned over to the dispatch office his assembly material sheet.

The dispatcher pulls the order packet for this particular weldment (the order is on file in the office, having been received from the department most recently concerned with fabricating the part).

All order packets carry a priority number, and the dispatcher will use this as the guide to scheduling the work on the board. When its turn comes, the order packet is assigned to an operator, placed into his slot on the board.

When checking into the office to start his work shift, the weldor will be handed his assignment. Upon completion of his shift, the time is entered in the records and the order returned to the board. If another weldor on the next shift is to continue on this same project in the same area, his name is substituted on the board.



The importance of polarity in arc welding

by **Bela Ronay**

WHEN THE ARC WELDING era first began, bare wire electrodes were used with d-c generators as the power sources.

In the d-c arcs, heat concentration at the positive pole was known to be about 40% greater than at the cathode end. It was also known that because of the bare wire's sluggish metal transfer, the percentage of the wattless periods was high.

Consequently, preparation of the base metal to receive weld metal was improved considerably by making the base metal the positive pole, *i.e.*, straight polarity.

But as shielded-arc electrodes were developed, it was more advantageous to change the polarity, applying the greater heat concentration to melting the inorganic, slag-forming coating, *i.e.*, reverse polarity.

With reverse polarity, the geometry of the penetration under a bead is comparable to a segment of a flat ellipsis. On the other hand, with straight polarity, the penetration pattern is comparable to a triangle with a blunted apex.

Depth of penetration under straight polarity is almost twice that of reverse polarity. And using a-c as the power source, the penetration pattern becomes a composite of the two patterns mentioned above.

When welding sheet metal with straight polarity, where the hot cathode (negative pole) is the electrode, it is practical to maintain the arc on the base metal ahead of the deposit. This prepares the base metal for fusion with the deposit at a faster rate than with reverse polarity where base metal is heated indirectly through the deposit.

Using the above principle, vertical downhand welding of sheet metal assemblies provides an effective bond between weld and base metal. The weld bead is smooth since the hesitation which builds up lumps and the coarse ripples in reverse polarity uphand welding is absent.

Among the various brands of E6013 electrodes, there are several particularly suited to welding sheet metal in this manner, and at a faster rate than practical with reverse polarity.

Design engineers are usually unaware of polarity's effect on the penetration pattern when fillet welding, and experience shows they are also

quite liberal in dimensioning fillets.

Thus, overwelding is common. And since much fillet welding is done with E6010 electrodes at reverse polarity, it is conceivable that root penetration is often incomplete.

For statically loaded structures, where fillets are oversize, lack of root penetration may not be serious. For dynamically loaded structures, however, particularly if subject to abnormally low temperatures, the lack may be objectionable since it may constitute a trigger zone for brittle fracture.

With reverse polarity, when weld metal is the cathode, the arc is maintained between the hottest portion of the deposit and the tip of the electrode.

Starting a fillet weld, the arc is established against the two points first contacted by the bare electrode tip. Therefore, it is bifurcated, and remains so unless the welding rate is slow enough to shift the arc to the deposit's center.

When the arc is centered, the root is nearer the point of maximum arc temperature, and becomes sufficiently preheated to fuse with the deposit.

With straight polarity, the electrode is the cathode and the arc is maintained between the electrode tip and a point on the base metal directly opposite it.

In fillet welding, the electrode is aimed into the root, maintaining the arc between root and electrode. Thus, the root zone is heated directly. This is important for dynamically loaded weldments since root penetration provides a few additional percent of shear area, and therefore, a reduced stress level. In addition, penetration precludes a stress raiser at the root.

The most effective way to assure root penetration is to use AWS-20 or 24 grade electrodes at straight polarity. However, these electrodes are applicable in the flat and horizontal positions only. For welding fillets in the vertical or overhead with straight polarity, AWS XX12, 13, 16 and 18 electrodes should be used.

Because of the triangular-shaped, deep penetration of electrodes used with straight polarity, 100% joint efficiency can be obtained in square butt joints between ⅛-in. plates welded from both sides.

For economy, fabricators usually restrict root spacing of beveled butt joints (to be welded from one side only against backing strips) to the nominal diameter of the electrode to be used in the first pass. The result is often a streak of slag at both corners of the weld root, or lack of fusion or both.

Unless the weldor makes the first pass exceptionally heavy, thereby producing a condition favorable to full penetration at the root, these conditions remain. Using straight polarity, the favorable condition is automatically provided, even though root pass thickness is kept normal.

In deposition of the first pass in double Vee-joints where a separation between lands exist, reverse polarity is indicated. The bifurcated geometry of the first pass favors penetration into the side walls rather than dripping into the crevices between lands.

Thus, using reverse polarity electrodes is more economical for root passes in double bevel joints since it requires less chipping to reach sound metal than if the first pass were deposited at straight polarity.

The difference between the penetration patterns obtained in deposition into the root pass of a single bend joint is shown by results in qualifying weldors on the Navy No. 1 qualification test set up in the vertical position.

Using reverse polarity electrodes, weldors unaware of the need to deposit the root pass as an exaggeratedly heavy bead, failed the root bend test, although X-ray examination may have shown no slag inclusion at the root.

The same weldors, using straight polarity and applying the same technique as to bead size and incremental length passed the root bend test successfully. When qualifying weldors, remind them that the first pass using reverse polarity must be heavy and that straight polarity can be used with a normal technique.

The AWS XX10 and XX15 grades are reverse polarity electrodes; all a-c/d-c electrodes can be used at straight polarity. When using electrodes at straight polarity, current rate should be 5 to 10% higher than normal for reverse polarity.

Using a-c/d-c electrodes with a-c, the current rate must be at least 10% higher than the normal value for d-c reverse polarity. The following presents an empirical method for establishing the normal current for various electrode types in basic positions:

(1) AWS XX10 and XX15 electrodes, reverse polarity only.

Mark off incremental lengths of 3½ to 4 in. for 5/32.-in.-diameter electrodes (more or less in proportion to electrode sizes).

Deposit in the flat, on a ⅜-in. or heavier plate, several beads, varying the current value until a bead is obtained with least spatter, free of undercutting and with the ratio of crown height to width of bead at the toes no less than 1:2.5.

(2) Vertical and overhead welding with AWS XX10 and XX15 electrodes.

Mark off incremental lengths of 3 to 3½ in. for 5/32-in.-diameter electrodes (see above for other sizes). Deposit on a ⅜-in. or heavier plate several beads varying both the open circuit voltage and the current (if the power source is a variable potential set) until the least manipulation produces a smooth rippled bead.

In setting the controls, aim for the highest open circuit voltage and the lowest current rate applicable. When the power source is a rectifier, obtaining the normal current is easier as there is one variable only, the current setting.

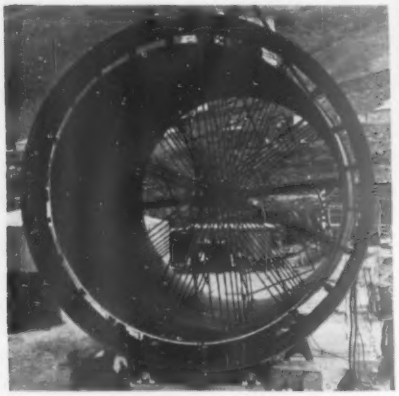
(3) A-c/d-c electrodes.

To determine the normal welding current for a-c/d-c electrodes, use the procedure given above for the d-c grades in various positions, to obtain normal current setting at reverse polarity.

When using these electrodes at straight polarity, raise the current value established for reverse polarity by 5 to 10% as applicable without developing undue spatter. When using them with a-c, raise the current rate established for reverse polarity by 10% or higher if practical, without occurrence of excessive spatter.

Welding electrodes, particularly of the a-c/d-c grades, are quite flexible in performance, as affected by the combination of polarity and current rate. Supervisors should develop a curiosity in this respect and study the performance of these electrodes under the various applications for which they are intended.

CYLINDER or can is moved into position on the assembly rollers. Sheds on top of other sections protect welding operations from weather. Trailer in foreground houses two 750 amp d-c generators. Head-on view (below) shows spider rods used to assure absolute roundness.



Idaho dam's penstocks rely on submerged-arc welding

by **E. H. Weil**
The Lincoln Electric Co.
Portland, Oregon

CUTTING THROUGH the solid rock in Idaho's Hell Canyon are four separate penstocks for the Brownlee Dam hydro-electric project.

Each tunnel, measuring 520 ft in length with a 24-ft diameter for most of their length, is lined with continuous steel cylinders fabricated with submerged-arc welding at the site.

Contractor for the project is the Morrison-Knudsen Co., Boise, Ida.

In each 520 ft section, 434 ft was lined with 24-ft-diameter cylinders, or cans, varying in plate thicknesses from ¾-in. at the tunnel top to 1 5/16 in. at the bottom. Remaining sections at the tunnel's lower end are reduced to 18 ft in diameter and fabricated from 1 5/16-in.-thick plate.

Prior to welding, all sections were given an inside 30-deg bevel and a ¼-in. land to provide a 60 deg included angle in the joint. This form of edge preparation was used throughout the penstocks on both longitudinal and girth seams.

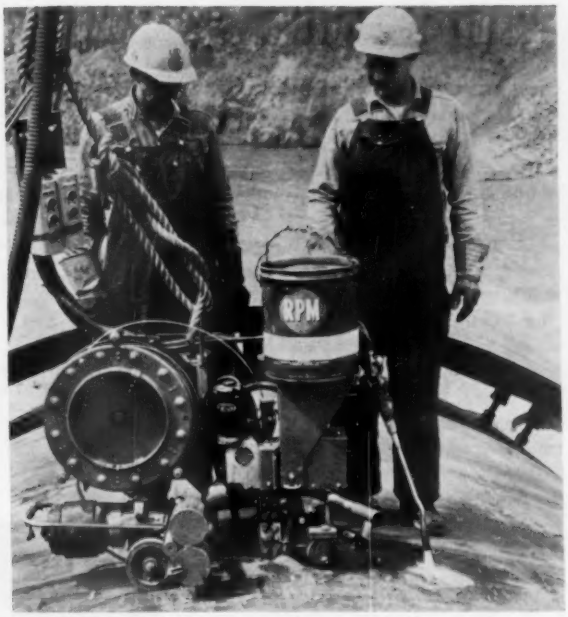
Three longitudinal seams formed a complete can 24 ft in diameter and 7½ ft long. To assemble these spidered cans, large cranes placed them on turning rolls consisting of two powered and eight idle rolls. At each of two such stations, one-half of the rolls were mounted on carriages and the other half were stationary.

Submerged-arc welding joined the individual cans into 60-ft sections while automatic submerged-arc welding heads, mounted on self-propelled tractors, welded both longitudinal and girth seams. Two parallel 750 amp motor generator units supplied d-c welding power.

When welding girth seams, the tractor's speed was synchronized to

GUIDE wheel riding in joint keeps tractor on seam. The gas torch was necessary for plate drying to eliminate moisture porosity in the joint.

WELDORS join bracket to section for mounting on Athey trailers which move sections to the tunnel.



Back-up pass was made with the automatic submerged-arc tractor riding the outside diameter of the can.

the turning roll's speed. A level mounted on the control box helped to keep the tractor on center, while a guide wheel, mounted on the tractor's forward section, rode the groove to keep the weld in the proper position on the seam.

This guide was used for the root pass and succeeding passes until the groove was filled, after which a light was utilized to guide on the final passes. Possibility of weld-contaminating moistures was eliminated by placing a heating torch just forward of the welding unit.

Filling the 60-deg included angle on ¾-in. plate required two passes at 750 and 900 amp respectively on the inside, and one pass at 1,000 to 1,100 amp on the outside.

To prevent the arc from burning through the ¼-in. land due to varying fit-up, a spring-loaded, water-cooled back-up bar was used when welding the root pass. This procedure eliminated a costly, time-consuming manual root pass.

The number of passes increased with the plate thickness up to 1 5/16 in. where a maximum of five passes were used with a final pass at 1,150 amp. With this procedure, sound welds of 100% X-ray quality were obtained with maximum penetration and without the usual need for back-chipping and air-gouging.

All automatic welding was done with 3/16-in.-diameter mild steel wire. Evidence of high quality and low fabrication cost can be seen in the fact that of 25,927 ft of automatic welding, only 127 ft, 9 in. was rejected, or less than one-half of 1%. During one month alone some 1,055 lineal ft of longitudinal and 3,075 ft of circumferential welds on ¾-in. plate were completed in 20 working days with two automatic units on two shifts.

The completed 60-ft automatically-welded sections were composed of eight cans of 7½ ft plate widths, and weighed from 70 to 100 tons each. The sections were moved into position at the base of the tunnel on Athey trailers.

These sections were then transferred to concrete skids and hoisted to the top through the tunnel. Manual arc welding was then used to join the 60-ft sections with iron-powder, low-hydrogen electrodes to complete penstock installation. These welds were also X-ray inspected.

When completed, the project will almost double Idaho Power Co.'s capacity. With an initial capacity of 360,000 kw, it will be the largest of three dams authorized for construction by the Federal Power Commission in the Snake River area.

. . . and at the Fort Peck dam in Montana

THE LARGEST earth-filled dam in the world is being built at Fort Peck in northeastern Montana by the Army's Corps of Engineers.

Scheduled for completion in 1961, the dam's power tunnels are lined with A 131-C steel in thicknesses of 1 in. and 1 1/16 in. to help deter the erosion caused by rapidly flowing

OVERALL view shows derrick raising can which will be lowered into area where it will be welded to another can to make one section.

water through the tunnel.

Each complete ring, with a 24 ft, 4 in. ID, consisted of three plates with T-beam stiffeners shop attached, leaving only sufficient space on either side of the joint to fit the seam with key plates and to manually arc weld a hand pass to keep the plates aligned.

Prior to welding, each plate was given a 60-deg, double-Vee edge and a preheat treatment, before and during welding, of 200 F.

All rings were pre-assembled with concrete foundations to maintain levelness. At the same time, prior to manually arc welding for alignment, spider rods were installed to assure absolute roundness of the completed unit.

These sub-assemblies were then hauled to the pre-assembly shop where three rings were assembled into one unit on rollers, fitted together, and then automatically submerged-arc welded using 1/8-in.-diameter wire.

These assemblies, or cans, were then readied for X-ray inspection on the roller beds, and all weld repairs were made before removing the can from the rolls.

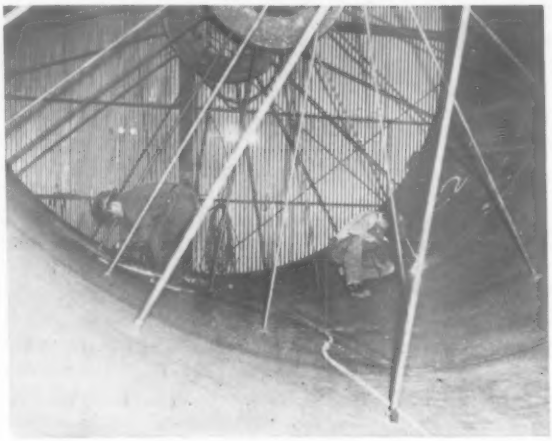
Two such cans were then assembled at the ground level area at the tunnel end where the seam between the two cans was then automatically submerged-arc welded. The unit was moved up into the tunnel to be manually arc welded with 5/32-in.-diameter E7018 electrodes.

Most of the power sources used were rectifiers, although some motor generator units were used.

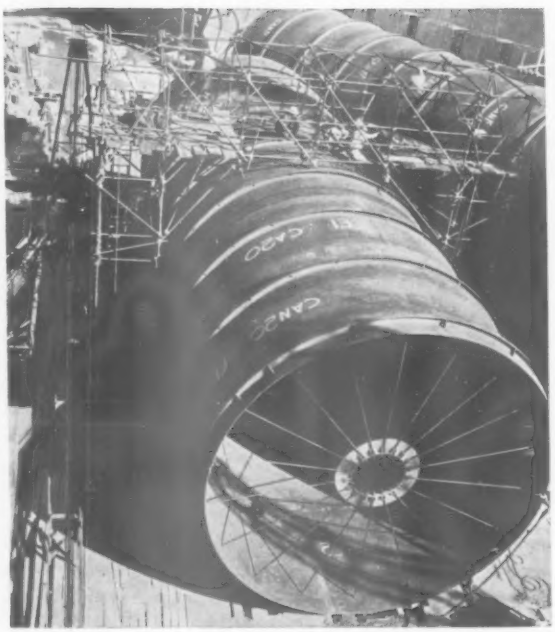
COMPLETED subassembly shows spider rods and stiffener angles used to insure roundness.

SUB-assembly of three rings is automatically submerged-arc welded using a 1/8-in.-diameter wire.

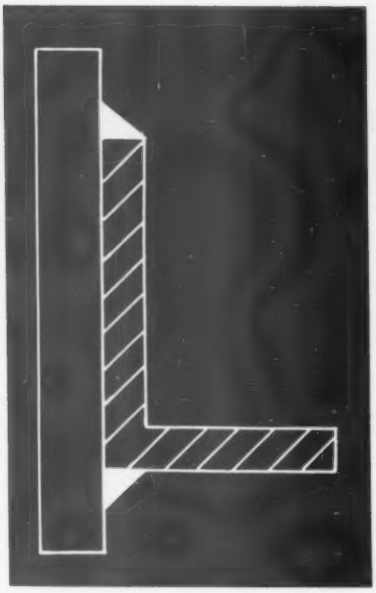
Photos courtesy Chicago Bridge & Iron Co.



WELD repairs on the completed cans were made before removing them from the rolls.



TWO cans are welded together by submerged-arc process at ground level area at the tunnel end.



How to determine required strength of fillet weld on angles

by **Nicholas S. Hodska**
Sikorsky Aircraft Corp.

PROPER DESIGN of a fillet weld on angles implies an optimum balance between the weld's effective length and the contact area between it and either base metal part.

However, making welds "big enough" (or effective) and actual lengths "generously sized," can lead to unnecessary weight and cost sacrifices.

Frequently, loss calculations for stress distribution among separate welds are slighted because fillet welds on angles are ordinarily designed to resist only forces tending to develop shearing stresses in welds.

Such forces may act parallel to the weld length, at right angles to it or inclined to it.

Yet in systems where operating stresses are high (heavy machinery, ship and building construction) and miles or more of framework and angles are used, shearing stresses can be a large percentage of the total system of individual welds.

Thus, a sound engineering approach is mandatory, and allowable shearing stresses must be accurately calculated to obtain weld sizes and lengths giving the most economical application of strength, joint efficiency and margin safety.

In dealing with angles, the welded joints must be proportioned properly and in a proximate manner to reduce internal stresses and strains which often cause buckling, distortion and ultimate failure. These stresses are due to the differential expansion occurring with heating or cooling of a weld.

Uniform heating of the entire part is not always possible or desirable to substantially reduce internal stress, and contraction stresses will invariably exist after the weld cools. If the weld is too small, it may actually fail and break as parts adjacent to the weld contract.

The correct weld size and length, therefore, would normally withstand the load and the internal stress would remain in the base weld metal. Keeping the amount of welding to a minimum will also lessen distortion, internal stresses and the need for stress relieving.

When designing a fillet weld, weldability cannot be properly discussed without consideration and careful investigation of individual welding conditions, *e.g.*, machine design, section thickness, accessibility, service requirements, manufacturing costs. Nevertheless, it is essential to consider the size instead of the throat of a fillet weld.

With general type fillet welds, in which the cross-section is an isosceles right triangle, the throat is equal to the product of the size and sine 45 deg; that is, T=L sine 45 deg=0.707L (figure 1).

Any weld metal outside the triangle limits is omitted in estimating weld strength. Thus, the material between the dashed line and the curved surface of the weld is considered extraneous and disregarded.

This excess material is termed reinforcement, and the curved surface is referred to as the bead. The equal sides of the triangular cross-section of a fillet weld are in the original fundament surfaces of the base metal parts connected by the weld. The length of either of these sides or fillet legs, as dimension D, is used as a measure of the weld size.

Overwelding or excessive weld size is costly, since weld metal increases as the square of the weld size. But there is always a tendency to add more reinforcement.

Therefore, convexity of a fillet weld should be reduced, since a 45-deg flat fillet is the most desirable and suitable shape for weld performance. For equivalent strength and rigidity, long fillet welds with smaller leg sizes are less costly than shorter ones with larger legs.

To obtain the greatest strength and rigidity, provision is often made for transmitting stress from one member to another by two or more separate welds when two members of a structure are welded.

In figure 2, a stress (S) is transmitted from one angle to another through two welds. The combined strength of all the welds connecting the two members should be at least equal to the total stress transmitted from one to the other.

The weld strength of length L_1 at the angle toe must have the same moment about the weld of length L_2 at the angle heel as does the total stress in the angle. Conversely, the

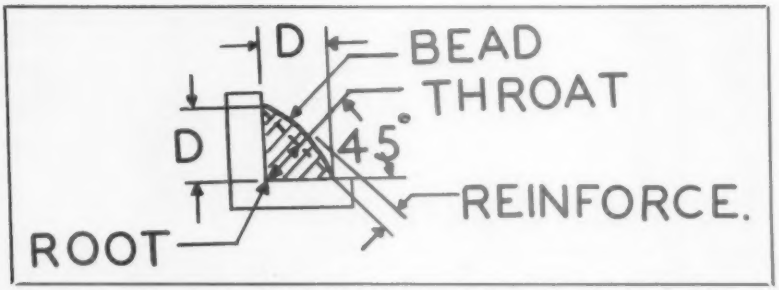


FIG. 1—General type fillet weld in which cross-section is an isosceles triangle and throat is equal to product of the size and sine 45 deg.

weld strength at the heel must have the same moment about the weld at the toe as does the total stress in the angle.

Whenever the stress in an angle is transmitted entirely by welds along the toe and heel of the angle, the required weld strength may be calculated as follows:

$$S_1 = \frac{S\,x}{d} \qquad S_2 = \frac{S\,(d-x)}{d}$$

S_1 equals required weld strength at the angle's toe in pounds

S equals total stress in the angle in pounds

d equals width of angle leg between welds in inches

x equals distance from back of angle to its center of gravity, and

S_2 equals required strength of weld at the angle's heel in pounds.

According to the recommendations of the Building Code of AWS and the American Institute of Steel Construction for steel in buildings, the allowable shearing unit stress of a section through the throat of a fillet weld made by shielded-arc welding is 13,600 psi.

This stress is to be used in conjunction with structural steel ASTM A-7, which is for structural steel having an ultimate tensile strength between 60,000 and 70,000. The factor of safety (about 4) applicable to building construction has been applied to the working stress.

Since 0.707 x 13,600 = 9,600, the required area of contact of a shielded-arc weld in a building problem may be determined by the following:

$$DL = \frac{F}{9{,}600}$$

where D is the weld size; L is the effective weld length in inches; and F is the resultant shearing force on the weld in pounds.

The following method, developed into nomograms, simplifies the determination of the required weld strength at heel and toe of angles.

The nomogram in figure 3 is used to determine the required weld strength at toe and heel of the angle. The nomogram in figure 4 is used to determine the effective length of welds. For example:

A 4-in. by 3½-in. by ⅜-in. angle, with a 3½-in. leg outstanding, is welded to a gusset plate in the manner shown in figure 2, with a ⅜-in. fillet weld. If the total stress carried by the angles is 14,000 lb, what should be the effective area of contact between each base metal part and a shielded-arc weld *(1)* at the angle's toe, *(2)* at the angle's heel, and *(3)* what should be the actual weld length?

Using figure 3, the width of the angle leg between welds is 4-in. Distance from the back of the shorter leg of the angle to the center of gravity is 1.21 in. Then:

(1) Locate 14,000 on S scale.

(2) Locate 1.21 on X scale.

(3) Connect these two points with a straight line to intersect the reference line.

(4) Connect point on reference line just found and 4 in. on the d scale. Read the required strength at the toe of the angle as 4,240 lb on the S_1 scale.

(5) From 4,240 value on S_1 scale and the circled cross draw a straight line and read the effective area of contact between the weld at the toe of the angle as 0.441 sq. in. on the DL scale.

For the heel, D — x = 4 — 1.21 = 2.79 in. The required weld strength at the heel of the angle is found as follows:

(6) Locate 14,000 on S scale.

(7) Locate 2.79 on (d—x) scale.

(8) Connect these two points with a straight line to intersect the reference line.

(9) Connect point on reference line just found and 4 in. on the d scale. Read the required strength of weld at the angle's heel as 9,770 lb on the S_2 scale.

(10) From 9,770 value on S_2 scale and the circled cross, draw a straight line and read the required effective area of contact with the base metal part as 1.017 sq in. on the DL scale.

To find the actual length of weld necessary in the above two cases, first determine the length of weld at the toe of the angle. From figure 3, DL = 0.441 sq in. and the size of the weld is given as D = ⅜ or 0.375 in.

Using figure 4:

(1) Locate 0.441 on the DL scale.

(2) Locate 0.375 on D scale.

(3) Connect these two points and read the effective length of 1.176 in. on the L scale, and the actual length should be L + D = 1.176 + 0.375 = 1.551, or 1⅝ in.

Finally, determine the length of the weld at the heel of the angle, again using figure 4:

(4) Locate 1.017 on the DL scale.

(5) Locate 0.375 on D scale.

(6) Connect these two points and read the effective length of 2.712 on the L scale. The actual length should be L + D = 2.172 + 0.375 = 3.087 or 3 3/32 in.

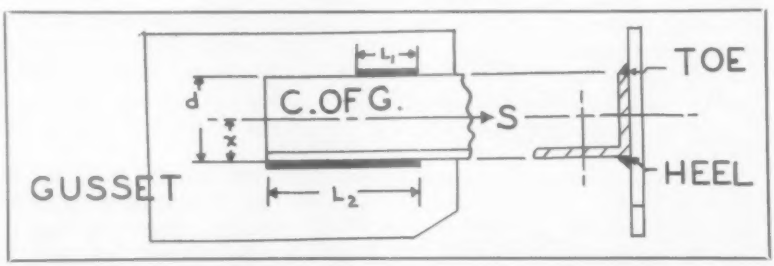


FIG. 2—Stress is transmitted from one angle to another through two welds. Combined strength of all welds connecting two members should be at least equal to total stress transmitted from one to the other.

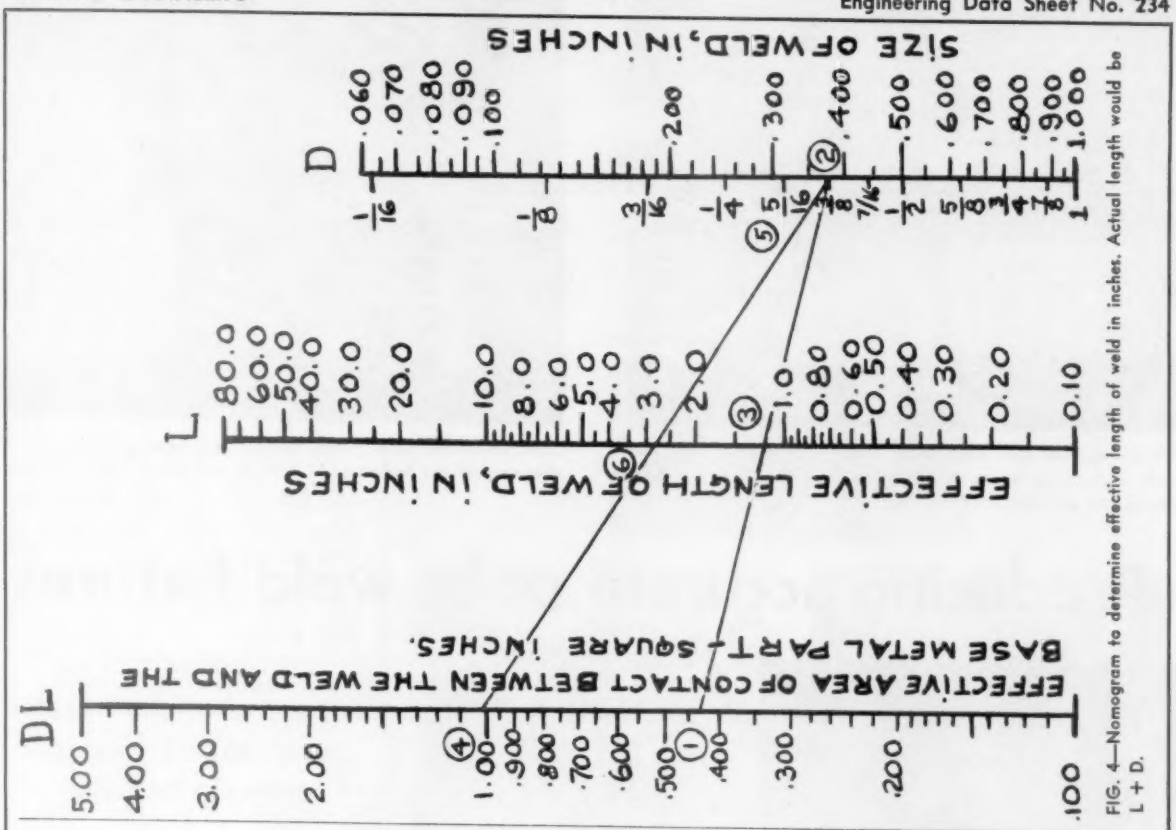

SIZE OF WELD, IN INCHES
D
EFFECTIVE LENGTH OF WELD, IN INCHES
L
EFFECTIVE AREA OF CONTACT BETWEEN THE WELD AND THE BASE METAL PART - SQUARE INCHES.
DL

FIG. 4—Nomogram to determine effective length of weld in inches. Actual length would be L + D.

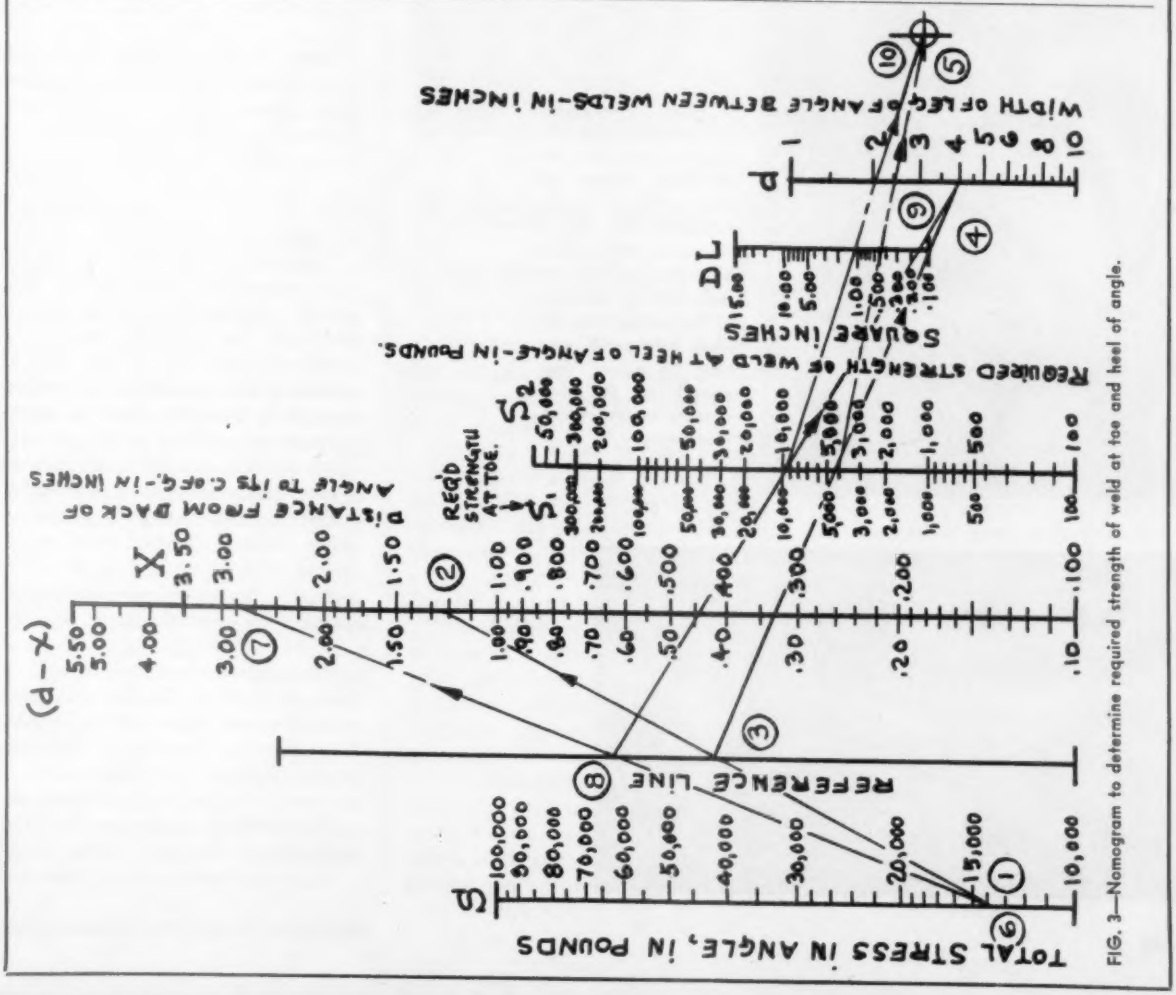
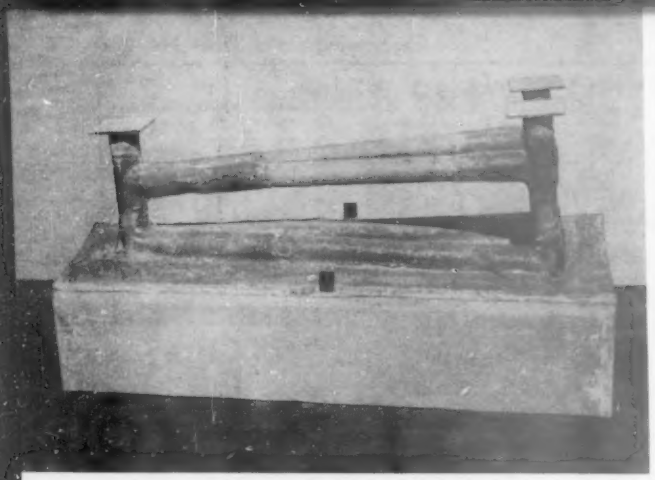
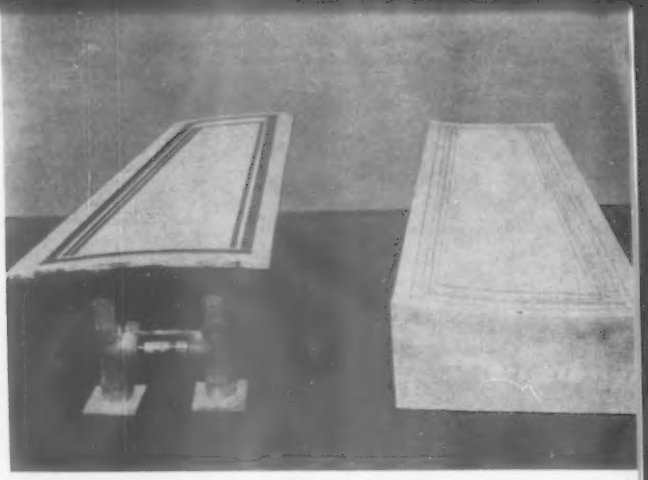

TOTAL STRESS IN ANGLE, IN POUNDS
S
REFERENCE LINE
(d - x)
DISTANCE FROM BACK OF ANGLE TO ITS C. OF G.-IN INCHES
X
REQD STRENGTH AT TOE.
REQUIRED STRENGTH OF WELD AT HEEL OF ANGLE-IN POUNDS.
SQUARE INCHES
DL
WIDTH OF LEG OF ANGLE BETWEEN WELDS-IN INCHES
d

FIG. 3—Nomogram to determine required strength of weld at toe and heel of angle.



TO produce the poke weld fixture lay-up of glass cloth and epoxy resin is made on master model taken from actual prototype of honeycomb sandwich structure.



COMPLETED reinforced epoxy fixture at left showing copper strips embedded in the laminate. At right is cast epoxy master model.

Producing accurate poke weld fixtures

A fixture is employed for assembly of a tail-pipe shroud for the Lockheed Electra at Rohr Aircraft Corp., Chula Vista Cal. One of the main difficulties in production of the fixture was the accuracy of the contour since the steel honeycomb core must be placed close enough to the steel skins to ensure permanent joints.

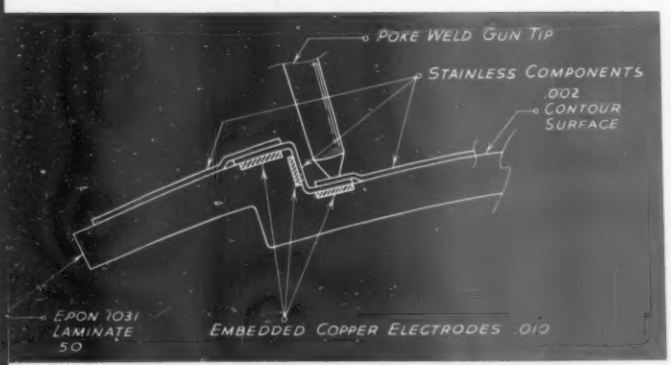
by **Charles H. Miller**
Ampac Co., Inc.,
La Mesa, Cal.

New tooling method uses glass cloth, epoxy resin to make accurate fixtures at low cost

A NEW TOOLING method utilizing laminations of glass cloth and a high heat-resistant epoxy resin has made it possible to produce extremely accurate poke weld fixtures in almost any size, shape or contour at less than half the cost of conventional fixtures.

Standard weld fixtures for stainless steel honeycomb structures are difficult to produce to accurate contours and their cost is high. One of the main problems lies in the need to place the steel honeycomb core close enough to the steel skins to ensure permanently welded joints. Honeycomb welding demands tolerances no greater than 0.002 in. to be effective.

Still another drawback is the tedious amount of hand scraping required to contour copper electrodes and still be within specified tolerances. This consumes much time.



These problems have been overcome by reinforced epoxy resin poke weld fixtures which differ greatly from previous attempts to fabricate plastic fixtures. In those cases, a laminate was prepared first and the copper welding electrodes then riveted into it. This quite often created a meniscus between each rivet that

threw the fixture out of tolerance.

Attempts to grind the fixture were ineffectual because too much material would have been shaved off. There was no satisfactory solution until the introduction of epoxy type resin, capable of high bond strength at elevated temperatures.

The first set of high temperature resistant fixtures was made for aircraft primary structures. These parts consisted of 0.010-in. stainless steel outer jacket welded to a 0.003-in. stainless steel honeycomb core.

Copper electrodes were cemented down to the surface of the model, so that the completed fixture could later be easily removed from the model. After the copper strips had been cemented down, the copper grounding lugs were silver soldered to the strips. The assembly was then ready for lamination, the first step of which was to etch the copper with nitric acid to remove surface oxides. Acid residue was washed off.

Close tolerances prevented the use of conventional parting agents such as waxes and polyvinyl alcohol. Instead, fine rice paper 0.0005-in. thick was applied everywhere on the surface of the master model but not on the copper strips. The uniform thickness of the rice paper guaranteed that there would be no more than a 0.0005-in. deviation in the fixture.

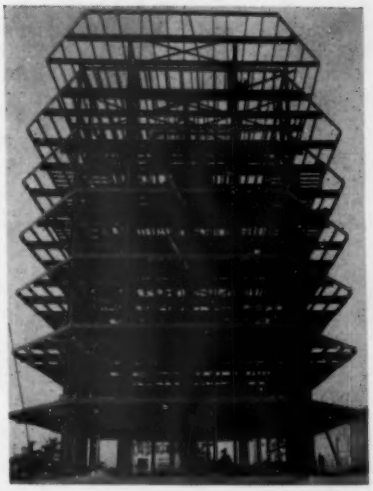
The epoxy resin formulation prepared for laminating, based on Epon 1031, not only possesses high strength, good adhesion, chemical resistance and excellent electrical properties, but has the added advantage of resistance to high heat.

In the laminating procedure itself, an extremely thin glass cloth was used instead of a gel coat to avoid the difference of shrinkage which might have occurred between a gel coat and a backing bonding cloth.

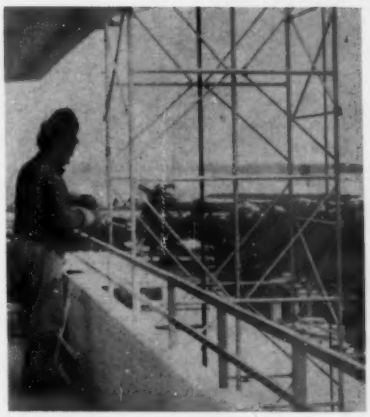
The thin cloth was impregnated with the epoxy resin and then laid up on the master model. This was followed with nine additional layers of tooling cloth. The 5/8-in.-thick laminate was allowed to cure at 70-75 F for four full days, with only contact pressure maintained.

When the fixture was removed from the master model, the copper electrodes were embedded in the laminate in the exact contour required for welding.

RIGHT, a close-up of the seven-story motel shows where 816,000 lb of structural steel and 1,560 lb of E6010 electrodes went in building this "first" for the Florida west coast. Four d-c arc welders, two electric-motor driven and two gasoline driven, supplied the current.



BELOW, at left, is part of the motel's handrails, which took more than one mile of 1-in. and 1¼-in.-square steel tubing. At right, a welder for Sarasota Welding & Supply Co. joins metal plastering lath to the steel framework in preparation for plastering, using an E6010.



Welding helps raise Florida's first multi-story motel

A VERTICAL seven-story-high motel is the first to tower above conventional one story hostelries crowding the Sarasota, Fla., shores.

The new "Three Crowns Motel," built at a cost of $1.5 million, boasts an all-welded steel framework able to withstand the gales of tornado fury that sweep in from the Gulf of Mexico.

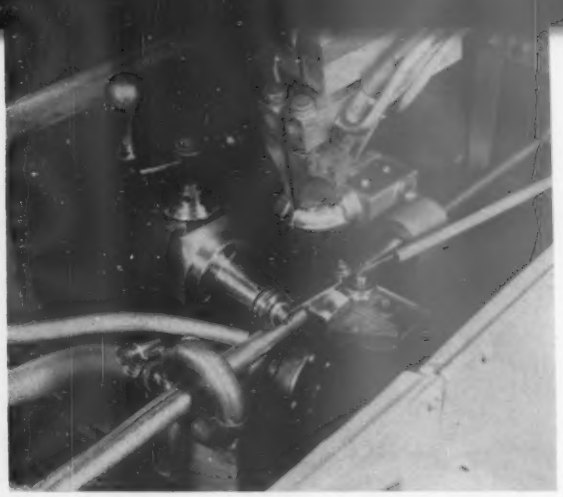
The building required 258 tons of structural steel, 150 tons of bar joists and reinforcing steel. Arc welding joined columns to joists and also fabricated the seven floor decks and an outside elevator shaft.

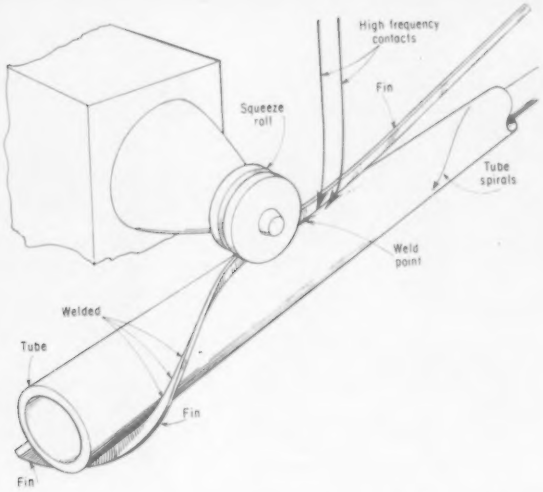
A total of 1,560 lb of E6010 electrodes in 5/32-in. and 7/32-in. diameters were used to weld the 816,000 lb of structural steel. The welding current was supplied by four Hobart Bros. Co. d-c arc welders; two were electric-motor driven, and two gasoline driven.

The steel framework on the building's front was sectionalized, and then welded to make an elevator shaft on the outside. Since each floor has glass blocks facing away from the shaft, and the rear of the elevator is glass, passengers can enjoy an aerial view.

The new, welded motel may set the pattern for future construction in Sarasota and other west coast sections. Motel operators cannot build horizontally and spread their units over a wide area because of high and still-rising land costs.

The only economical solution is to build skyward—and use welded steel frameworks.





SLIDING contacts are raised here to permit view of tube entering the enclosure through the louver trap at extreme right. Tube travels under the contacts to the squeeze roll and out. To right of tube, strip of metal to be welded can be seen entering through the feed sleeve. At upper center is handle which operates the worm gear to raise and lower the sliding contacts. Picture at right is diagrammatic representation of the operation. Tube is supported internally by a mandrel, not shown in diagram.

New method simplifies fin-to-tube welding

High-frequency resistance technique called faster, more economical

COSTLY, SLOW, or extremely difficult operations with either ferrous or non-ferrous metals now are easily accomplished by a new method of welding fins, ribs, or other continuous projections to, and with, tubing and flat metals at high speeds.

The technique can be utilized by manufacturers of heat convectors and exchangers, condensers, refrigerating equipment, and structural elements for airplanes, to cite a few examples.

Up to now, continuous welding processes, such as Tig (tungsten-inert gas) have been limited by the rate at which heat could be applied; consequently only slow or moderately fast production speed has been possible.

Spot welding techniques, on the other hand, produce localized heat many times the intensity of any other fusion method, and such a high heating rate facilitates joining sections which cannot be fabricated at lower heating rates.

The Thermatool high frequency resistance technique brings to continuous seam welding the same possibilities and advantages which spot welding and impulse have provided for joining metals at specific points, and with quality welds at speeds which cannot be accomplished with arc methods. Also, the thermal conductivity of metal fabrications currently manufactured by soldering, sweating, brazing, or pressing joints can be greatly improved by the new technique, according to the manufacturer, New Rochelle Tool Corp., New Rochelle, N. Y.

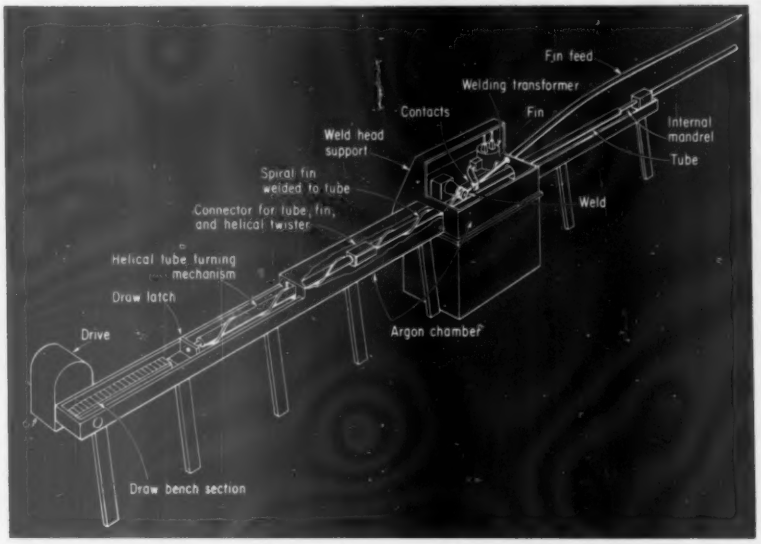
This technique is now operating in more than fifty installations around the world, producing tubing of ferrous and non-ferrous metals, including 100% conductivity copper, stainless and galvanized steel, hot and cold rolled steel, and the rarer metals such as zirconium and titanium, as well as metals of different characteristics —copper to steel, high speed steel to carbon steel—at previously unattainable speeds.

In this operation, current flowing across a metallic joint reverses at a very high rate, 450,000 cps, as compared to line frequencies of 60 cycles. This current does not follow the direct low-resistance path between the two contacts; rather it follows a very long, low-inductance path.

Edges of the metal to be bonded are positioned opposite each other as the strip travels through the forming mill (in the case of tubing, any standard forming mill). The high frequency current is introduced into the metal by means of two sliding contacts which ride on each side of the open seam about one or two inches from the root of the Vee in which the latter is positioned.

Each side of the Vee is a return conductor for the other, since the tendency of current flowing in the low inductance path is to flow on the two surfaces of the material facing each other—the surfaces to be welded. Due to the "narcissism" of high frequency current, it hugs the opposite edges of the metal. This skin effect produces localized high intensity heating so the edges at the root of the Vee reach welding temperature.

Pressure applied at the root results in a forged weld—lap, mashed lap or butt-edge, as desired. This method permits tubing or strips of ferrous or non-ferrous metal to be welded at very high speeds. It also makes possible the welding of strip to tube, and many odd combinations.



An interesting application of this process involves the welding of a spiral Zircaloy fin to a Zircaloy tube which has been previously welded by this method. Due to the fact that the tube must rotate to permit the fin to be welded helically, this operation cannot be a continuous process, but must of necessity be accomplished on a draw bench in finite length.

The strip to be welded to the tube is introduced through a fin feed, and tube and fin are brought together as an elongated Vee in an argon chamber, where one of the sliding contacts rides on the tube and the other on the fin. The contacts provide high frequency current for welding temperature.

Ends of the tube and fin are locked at the connector to a specially designed cam bar, which causes a spiral movement of the tube as it travels longitudinally through the draw bench.

This process, in addition to welding tubing and strip metal of infinite length, can be used to weld on a continuous basis:

—Flat strip, channel or inverted channel to tubing.

—Corners of square or rectangular tubing.

—Structural shapes such as "I" beams and double "I" beams that cannot be extruded or drawn.

—Odd "T" sections, either straight or at an angle.

—Two tubes of different diameters.

With tubing and strip metal of finite lengths the newly developed process is useful for welding:

—Spiral fin on tubing.

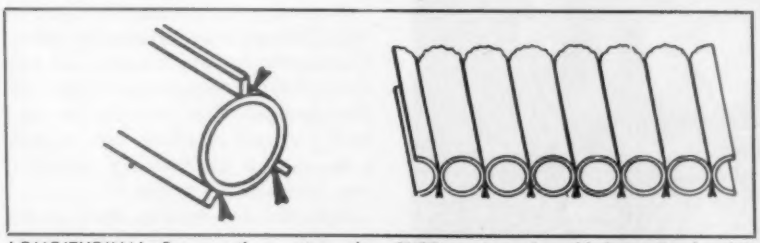
—Lip or edges to seal drum heads, etc.

—Tapered tubes, even heavy gage metal such as used in lamp posts.

—Perforated strip metal.

Many companies, according to the manufacturer, have compared their metal fabrication operations to this newer technique and have found that large economies can result.

Speed of production, low percentage of reject material, versatility in use of the welding head, small space requirements, elimination of flux and filler rod, reduction of scarf, and more feet of weld per man hour—these are additional claims made for the high frequency resistance technique.



LONGITUDINAL fins or ribs continuously welded to tube—used in automatic reactors, heat exchangers.

TUBE continuously welded to tube (used in furnace water walls).

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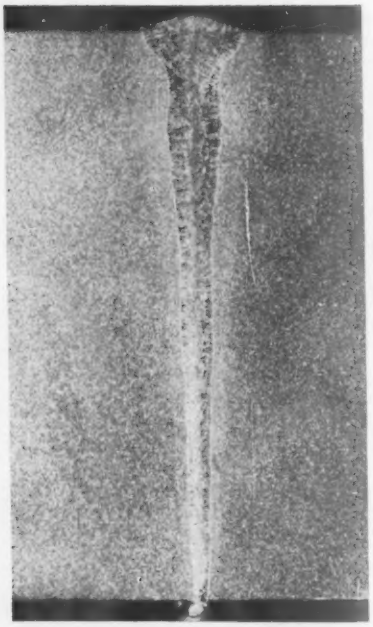

TYPICAL of the Zeiss electron beam welder is this one-pass weld made in 0.400-in.-thick stainless steel. No filler metal was added; bulge on face is probably an expansion effect. Weld was made by a 2 kw unit with special adjustments.

Newest electron beam entry is German-made

AT a recent demonstration, German-made electron beam welder was put through its paces.

WELDING operation can be seen through the magnetic lens with a binocular microscope with built-in illumination.

AS REPORTED last month on WELDING ENGINEER'S *Weld World* page, exclusive North American rights to an electron beam process developed by the Carl Zeiss Foundation, West Germany, have been acquired by Hamilton Standard, division of United Aircraft Corp.

The new process and its equipment can perform operations on the hardest materials or metals impossible with any other manufacturing or chemical process, according to Hamilton-Electrona, Inc., which handles sales and promotion in this country.

In laboratory tests, the electron beam has welded 1-in.-thick stainless steel and in production applications, ½-in.-thick stainless. Major improvements have been demonstrated in welding of reactor cores for atomic power installations and in milling of sub-miniaturized electronic components.

According to a company spokesman, electron beam equipment being manufactured in this country has not reached the Zeiss process' stage of development. This recently demonstrated system uses high voltage and a lens set-up for focusing the electron beam on the target.

Basically, the electron beam process uses a controlled high-density stream of electrons to change matter physically or chemically. A typi-

cal installation of the Zeiss process has six basic elements:

An electron gun develops a precisely-controlled beam of high-density energy electrons which are directed at the work piece. The material is heated, melted or vaporized according to the level of energy density in the beam.

A vacuum chamber and work table within the chamber on which the target, or material, is mounted. This includes equipment required for extremely accurate positioning of the target.

A high-vacuum pumping system capable of creating a near-perfect vacuum, about four-millionths of an inch of mercury. This approximates space at altitudes of about 400,000 ft.

An electronic control system for manipulating the electronic deflectors and lenses that control size and programming of the electron beam. Process operation can be observed through magnetic lenses by means of a binocular microscope with built-in illumination.

A precisely regulated high-voltage power supply, and monitoring instrumentation.

Used as a welder, Hamilton-Zeiss electron beam machine, as it is called, handles stainless steel for aircraft and missile structures, producing Tee-sections 60/1000-in.-thick from sheet stock at a rate of 48 ipm.

It can butt-weld $\frac{3}{8}$-in. stainless at $\frac{1}{3}$-in. per second, and as mentioned above, has welded 1-in.-thick stainless in the laboratory without distortion and with minimum grain growth in the weld area.

Lack of distortion is due to the narrowness of the heat-affected area (depth-width ratios as high as 20 to 1), while minimized grain growth is attributed to the extremely rapid heating and cooling (low total energy input to work piece).

The machine's design flexibility and its precise focusing of the electron beam permits the welding of complex shapes in hard-to-weld metals.

Studies have shown that electron beam welding offers the best answer to present-day welding problems of refractory metals, and it is fast becoming a major tool in aircraft and missile fabrication.

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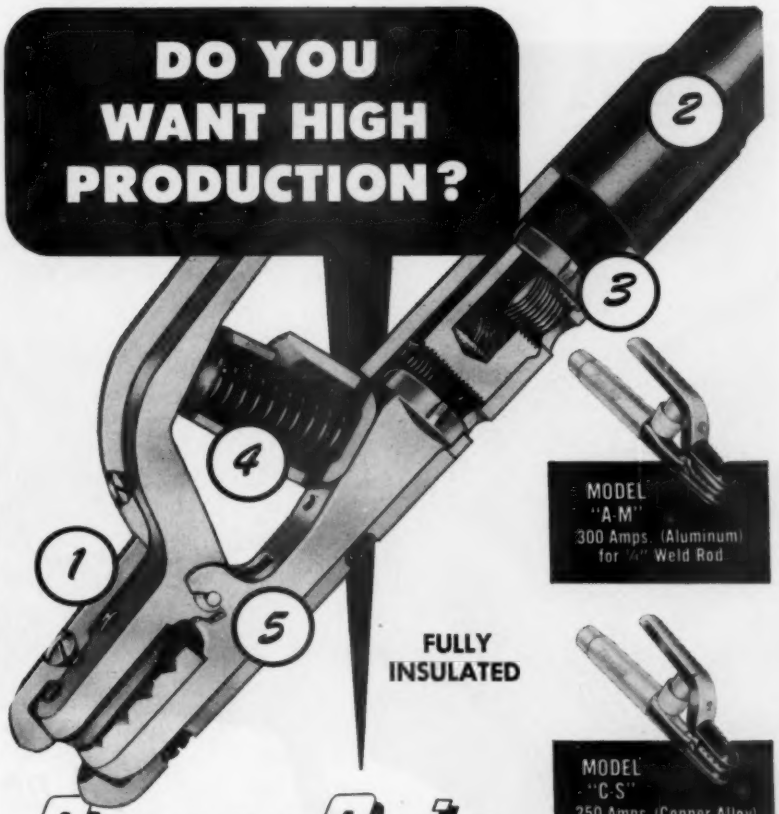

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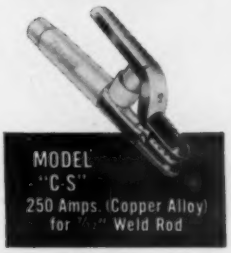

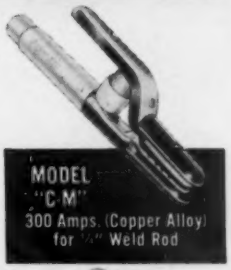

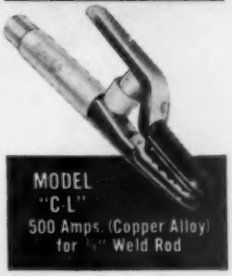

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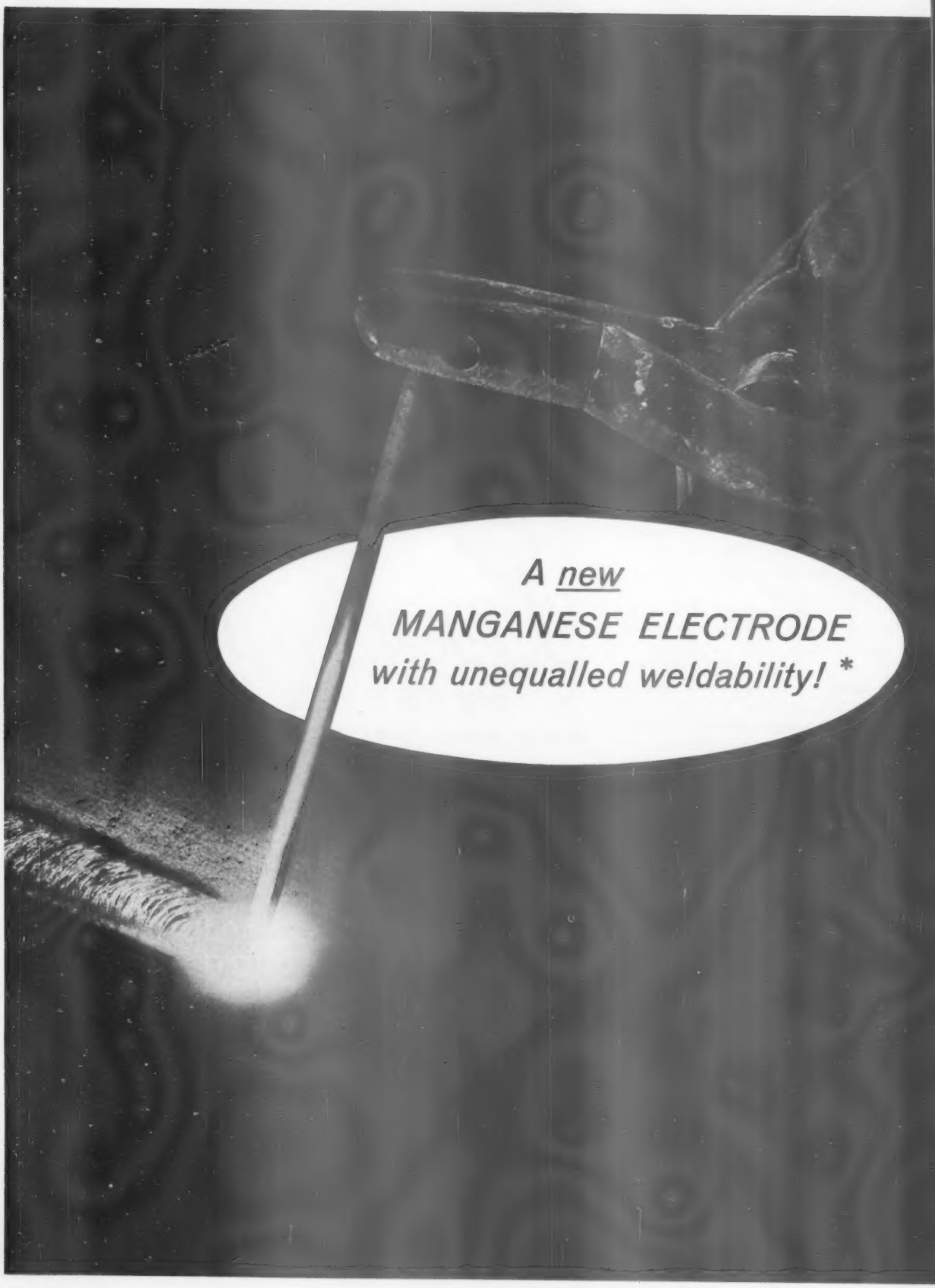
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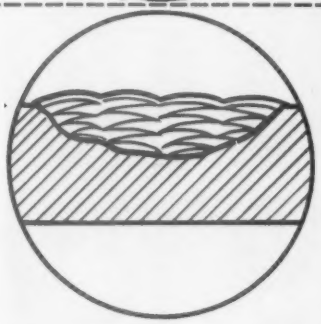


FOR BUILD-UP!

New Stoody Nickel Manganese electrodes solve manganese welding problems in the field or in the shop! You'll find it unexcelled for joining manganese parts or building up worn areas on manganese equipment. Stoody Manganese is now produced as a solid core wire on which the alloying elements in an iron powder coating are extruded. Unusual welding properties are obtained *with physicals unexcelled in the industry!*

Call your Stoody Dealer—check the Yellow Pages of your phone book or write for list of dealers serving your area.

FEATURES:

Stable arc – No popping	Freedom from cracks
Easy re-strike	No porosity
Fast deposition	Easy slag removal
Low spatter	Clean deposits

Cores are uniformly straight and coatings perfectly concentric—insuring a stable, smooth running arc.

Ask your Stoody Dealer for test samples...check speed and welding qualities, *test performance against every other manganese electrode you've ever used...* you'll find Stoody Nickel Manganese provides something *new* and *needed* in the industry!

PHYSICAL PROPERTIES:

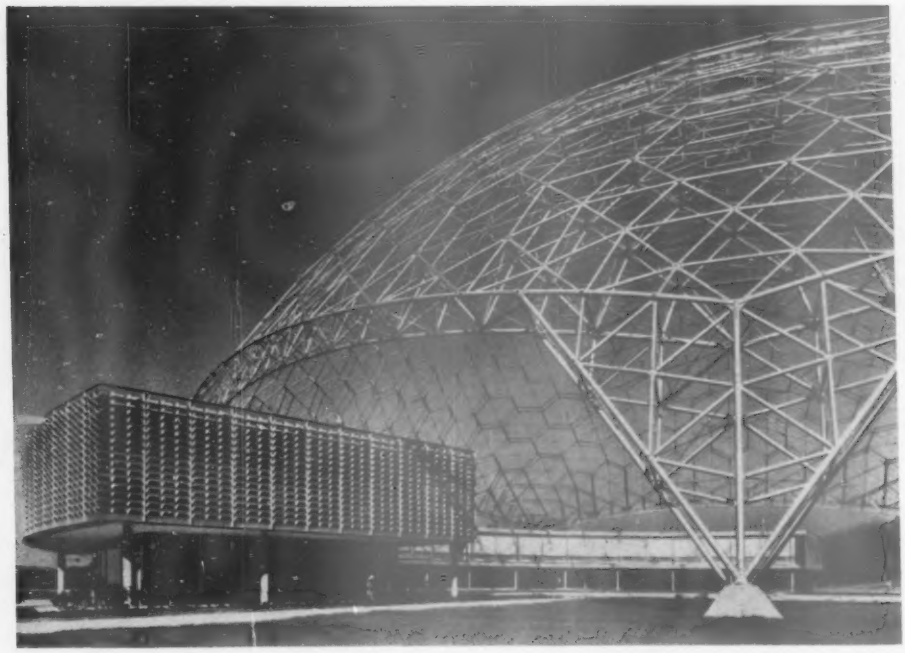
(Based on tests by independent laboratory)

	DC Straight Polarity	DC Reverse Polarity
Tensile Strength	119,000 psi	111,000 psi
Yield Strength	67,000 psi	66,000 psi
Elongation in 2"	55%	37.5%

Hardness—Single pass on manganese steel;
as deposited—15 Rc, as work-hardened—48 Rc.
Two passes on manganese steel;
as deposited—18 Rc, as work-hardened—48 Rc.

*Be sure that your Maintenance Superintendent and Welding Foreman see this announcement!

STOODY COMPANY
11984 E. Slauson Avenue
Whittier, California



COMPLETED dome's "space lattice" construction rests on one of five pylons. View shows inner arc of semi-circular building.

Welding helps support the ASM geodesic dome

THE 250-FT DIAMETER geodesic dome rising 10 stories above its 100-acre Ohio country-side site covers the new headquarters of the American Society for Metals—and welding played an important part.

The dome, fabricated of more than 5¼ miles of aluminum tubing and 7¾ miles of ¾-in. tension rods, is actually two domes in one with a 30-in. space between the two. Tubing for the base supports, pylons and connecting trusses are 6-in. in diameter, while all other components are 4-in. diameters.

The five pylons are T-type trusses, four of which rest on concrete piers, the fifth (within the courtyard) resting on steel. Footings of three of the five are supported by concrete-filled steel piling driven to varying depths (pylon base plates are 20 x 20 in. aluminum), from 24 ft at the dining room court, to 54 ft outside the library, to 77 ft at the courtyard entrance.

A tension ring links the five pylons to resist the dome's outward thrust. The ring is 18 ft below the ground, 272 ft in diameter with a 136 ft raise. Distance between footings is 75 ft.

The concrete pylon footings are connected by four 1½ in. No. 11 reinforcing rods, which were prestressed but not preheated or postheated. The rods were joined by manual arc welding using a 3/16-in. diameter electrode.

Power sources for the welding job, which required 300 man-hours for completion, were two motor-generator units rated at 200 amp each.

Stresses on the four rods are 125,000 lb, but welding has, and is, proving itself worthy of the task.

WELDOR joins reinforcing rods of tension ring which holds bottoms of five pylons supporting the 250-ft-diameter geodesic dome.

Best news in years about Resinoid Wheels!

Norton Reinforced Resinoid Wheels — rigid and semi-flexible — have long been an unbeatable team for handling an almost endless list of weld grinding jobs.

Today, these weld grinding favorites are produced in the new Norton Worcester Plant No. 8 — five acres of the very latest facilities for grinding wheel manufacture — where quality control, always a key factor at Norton, is now as thorough as ultra-modern equipment and development can make it.

- *Norton BD and BDA rigid wheels, raised hub type, glass-nylon reinforced, are ideal for grinding medium to heavy welds, including stainless steel — and for smoothing flame-cut edges, notching, slotting and cutting-off.*
- *Norton BFR semi-flexible wheels, raised hub type, nylon reinforced, are fast and free cutting in lighter weld grinding, removing scale, blending contours, scarfing and beveling before welding.*

For further facts on the latest, most outstanding progress in weld grinding wheels — both the reinforced types and straight, cups and cones — see your Norton Distributor. Or write to NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

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AUTO body enters temperature-controlled, air-conditioned booth where grinding and soldering operations are completed after gates are removed and small structural parts have been welded. Below, assembly line begins as gates are locked into gate-line base holding body floor pan.

Automation, welding help build Valiant

by **George E. Toles**

A UNIQUE METHOD of automobile body assembly is used by Chrysler Corp. to weld the unit body of its new compact car, the Valiant.

The entire body, from floor pan to fenders, comes together and is welded on a continuously moving gate-line assembly system.

The gate-line holds all basic parts, with the front and rear floor pans first assembled on a gate-line base travelling on a track. Each gate contains the cowl, side, roof rail, wheel-housing, quarter panel and sill assemblies.

The gates on either side are then sides and are locked into the moving track base. The various body parts being held in place are then fitted and welded.

The base continues along the assembly line with the gates attached as welders work inside and outside welding the various parts. Next the shelf and deck fit into place; reinforcement assemblies, the tail panel and the roof follow.

The gates on either side are then removed and sent to another floor area to be refitted with side parts while the base continues and side shields and front fenders are fitted. Then all spot welding, arc and gas welding is completed on the body.

The car proceeds to another stage for wire-brushing, soldering and grinding, after which the hood, front fenders, doors and deck lids are fitted and the body removed from the base to the metal finishing line.

This gate-line system is enhanced by heavy-duty welding—heavier guns with amperage raised to 75 and 130 kilovolt amp while previous methods used only 50 kva. Higher quality welds are assured with the higher amperage and increased pressure.

FASTENING a section of side sill to floor pan, weldor makes one of 5,200 welds required for Valiant body, which is designed to permit less expensive spotwelds and only a few arc and gas welds.

VALVAIR'S®

WELDING GUN CAP VALVE

Valvair's welding gun cap valve adapts to popular sizes of most welding guns, using an aluminum manifold adapter plate . . . gun handle mounts on valve.

compact...fast
...economical...

Eliminate unwieldy multiple hoses . . . eliminate operating lag caused by long exhaust lines . . . eliminate excessive air consumption associated with remote-mounted valves and lengthy hoses . . . eliminate surplus weight and difficulty in working in confined areas caused by cumbersome clamp-on control valves at the gun — switch to Valvair's integrally-mounted welding gun cap valve.

Sandwiched between the gun cylinder and the handle, Valvair's cap valve exhausts directly to atmosphere . . . provides split-second response for better welds and higher production rates.

Requiring only air supply and power lines, Valvair's cap valve makes the gun more manageable . . . cuts operator fatigue. Aluminum construction keeps total gun weight low, too.

The Valvair welding gun cap valve is built around Valvair's standard SPEED KING solenoid coil, guaranteed against coil burn-out for the life of the valve. It employs Valvair's user-proved design, with a pilot-operated stem floating in O-rings and provides the performance and trouble-free service users have learned to expect from all Valvair products. Coils for ac or dc, any voltage; mounting adapters for original installation or field conversion of popular welding gun makes and sizes. Your nearby Valvair or Bellows Field Engineer has all the facts.

8115

For more information, write for free Bulletin SVA-5. Address: Valvair Corporation, Akron 9, Ohio, Dept. WE-360.

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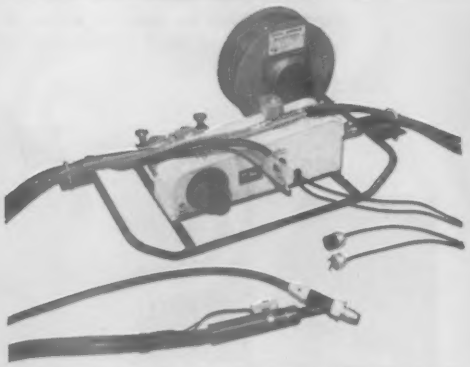
Other INDUSTRIAL DIVISIONS of IBEC: The Sinclair-Collins Valve Co. The Bellows Co., Akron, Ohio • V. D. Anderson Co., Cleveland, Ohio.

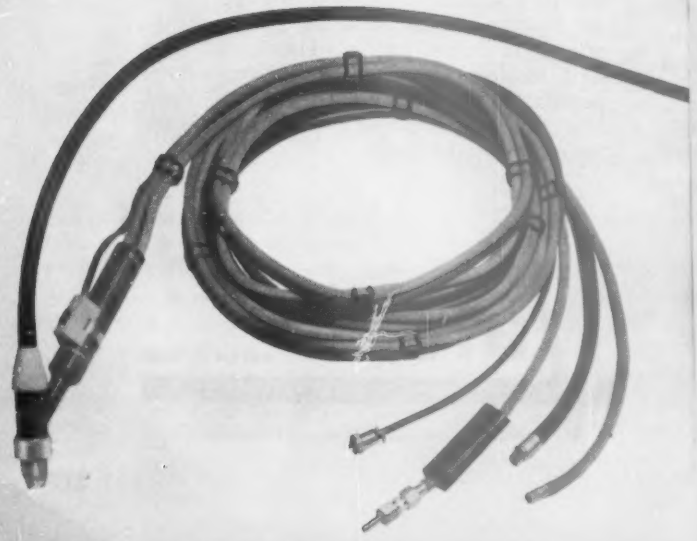
New NCG® Consumable

Newly designed, incorporating features that were developed to meet field requirements, the new WC-1 Welding Control Unit and the AM-1 Torch have advantages you should know about. Designed for Automanual* consumable electrode welding processes using Argon, Helium or Carbon Dioxide as a shielding gas, they provide maximum versatility and economy.



WC-1 Welding Control with Wire Drive

Double gate wire drive unit—1/10 HP Motor
Wire (3/64" to 1/32") feed rate: 55"—500" per min.
Clears 18" manhole—Weighs 55 lbs.
Easy to control
Sturdy, simple electrical components



AM-1 Torch

Unitized design—molded as one unit
Light weight—hand balanced
Delivers electrode and shielding gas to the arc
Complete package—all cables and hoses supplied
On-off switch on handle
Water-cooled cup

Electrode Welding Equipment

See the DUAL SHIELD welding process in operation during the 1960 AWS WELDING SHOW
April 26, 27 and 28th
Great Western Exhibit Center
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BOOTHS 417-418

DUAL SHIELD...

the carbon dioxide welding process that saves

The DUAL SHIELD* process is being used successfully by many plants, and the scope of its application, ranging from plain-carbon to low-alloy high-tensile steels, is constantly increasing. The oxidizing, scavenging and slag-forming flux compounds, the greater amount of weld metal deposited with better penetration, the higher welding speeds, the combination of inexpensive CO_2 and the flux compounds to provide arc stability, and the better weld quality obtained are all factors that contribute to the wide acceptance of DUAL SHIELD welding. Many are realizing good savings in reducing weld time and costs in spot welding and in foundry repair welding.

Four flux-cored electrodes are used with this process:

No. 110—A single-pass electrode for plain-carbon steels with a maximum carbon content of 35 points

No. 111A—A multipass electrode for the same steels welded by No. 110.

No. 150 and 151—Multipass electrodes for high-tensile low-alloy steels.

Since the cost of welding is a major factor in your operations, the DUAL SHIELD welding process and the new NCG WC-1 Welding Control Unit and AM-1 Torch can have an important bearing on your future profits. This new equipment is reasonably priced and the DUAL SHIELD process will cut production costs. It has for others and will for you.

Write today for more information...
Six page bulletin detailing
DUAL SHIELD Welding Process: NH 137.

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DIVISION OF CHEMETRON CORPORATION
840 North Michigan Avenue,
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CHEMETRON

NCG offices and authorized DUAL SHIELD *distributors are located in all principal cities.*
Consult the yellow pages for the office nearest you.

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THREE Mig units (above) are positioned at three stations in the welding area. Swinging boom and length of gas-and-water cable permits three welders to cover 1,600 sq ft. Close-up (below) shows wire-drive unit just above welder's head as he joins a side-section of a carrying frame.

by **J. J. Dolan**
Drott Mfg. Corp.
Wausau, Wis.

Applying proper welding process saves time and money for this manufacturer

THE MAJOR OBJECTIVE in designing Drott products is to anticipate fabrication methods to minimize welding time for each job, no matter how small or difficult, consistent with quality standards.

This principle of saving production time—and money—is based on matching each welding job with its optimum welding process, either automatic, semiautomatic or manualarc.

Automatic welding has been used for some time in all applications where high initial fixturing cost is more than compensated by its inherent speed and precision.

Manual arc welding has always been used where the small size of a welding job or production run would not justify the initial cost of automatic welding, as well as in applications not suited to automation.

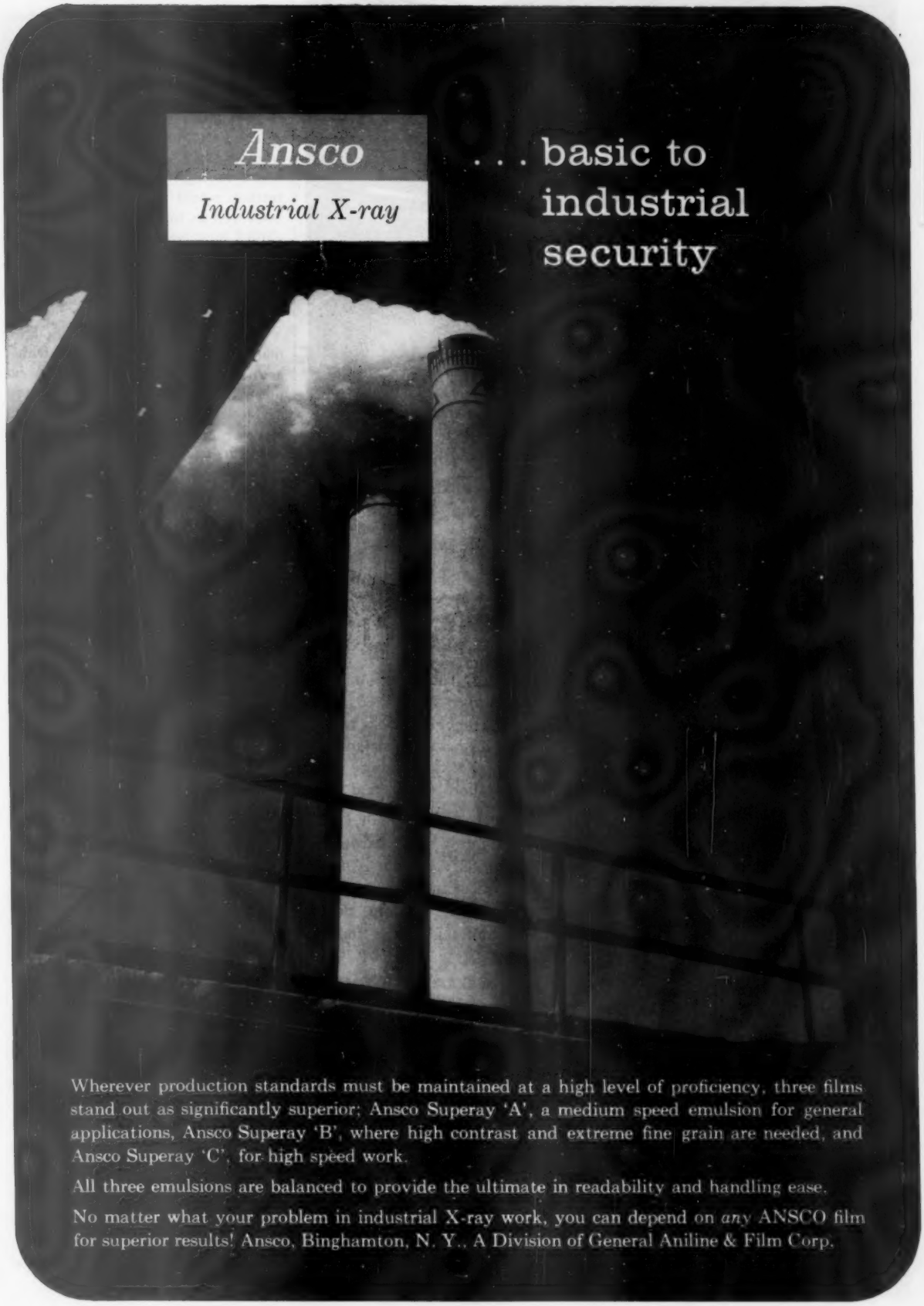
Until recently, however, semiautomatic welding did not play the major role of which it is capable in loader and attachment production for earthmoving and construction equipment.

Although it theoretically combines the advantages of automatic and manual arc welding, and has additional virtues of its own, manual welding still carried the greater welding load.

Recent installation of three carbon-dioxide Mig welding units, however, have produced consistently high-quality welds while significantly reducing welding costs on many products. Both its high-deposition rate and elimination of electrode replacement increased production capacity of existing welding personnel and facilities.

The CO_2 units, manufactured by National Cylinder Gas Div., Chemetron Corp., are positioned at three stations and mounted on a raised swinging boom extending from the back window-wall over the various welding locations.

Hanging freely from the boom are the gas and water cables connecting the control and wire-drive unit to the welding gun. The boom's arc swing, plus the length of the gas-



Wherever production standards must be maintained at a high level of proficiency, three films stand out as significantly superior; Ansco Superay 'A', a medium speed emulsion for general applications, Ansco Superay 'B', where high contrast and extreme fine grain are needed, and Ansco Superay 'C', for high speed work.

All three emulsions are balanced to provide the ultimate in readability and handling ease.

No matter what your problem in industrial X-ray work, you can depend on *any* ANSCO film for superior results! Ansco, Binghamton, N. Y., A Division of General Aniline & Film Corp.

Long-life overlay

. . . 5,000 FEET OF IT!

Typical AMPCO-TRODE® application with submerged arc or MIG

To protect against wear caused by sliding friction — to get years of extra service—this 7,500-ton forging-press ram was overlaid with Ampco-Trode 10 bare wire. Two submerged-arc heads were used, instead of one, to double the rate of deposit.

There are three Ampco bronze electrodes especially suited for automatic welding processes: *Ampco-Trode 10, Ampco-Trode 160,* and *Phos-Trode.* They give you a range of deposit hardnesses resistant to sliding wear, shock, squashing out, erosion, cavitation-pitting, and corrosion.

All are available also as bare and coated filler rods. Ask your Ampco distributor to recommend the Ampco-Trode that is right for you. Send coupon for bulletin. Do it today.

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W-155

and-water cable, permit the three weldors to cover the entire welding area of about 1,600 sq ft.

All equipment supplying each welding gun is located at the base of the swinging boom for easy access.

The CO_2 Mig welding process was immediately applied to all jobs where its high speed and deep penetration would provide the greatest reduction in welding time. These included long welds and deep welds in heavy materials—work which once required repeated electrode replacement.

For example, angle dozers have many long horizontal surfaces which are natural for CO_2 applications. Manual welding of the 9-ft-long blade top surface would require a new electrode every 14 in. of length or a total of eight electrode changes for each run.

Semiautomatic welding, on the other hand, requires an estimated 25% less time than manual arc welding on these same joints.

All present applications of semiautomatic welding have been on loaders and attachments originally designed with only automatic and manual arc welding in mind. A 2,000 lb mobile crane, soon to be introduced, will be the first product specifically designed to take advantage of the inherent characteristics of CO_2 Mig welding.

To further demonstrate the time saved with semiautomatic welding, a scarifier attachment, third largest of a series of four, originally required seven hours of manual arc welding.

In the first fabrication changeover of the same attachment, 4½ hours of CO_2 welding and ½ hour of manual arc welding were required. Now the scarifier requires only 4 hours of CO_2 welding and less than 10 minutes of manual arc.

Although material cost is greater with the semiautomatic welding process, a significant decrease in welding costs has been realized through production time savings. Similar cost reductions have been obtained with other products and are expected with future new products.

This is all made possible by simply applying automatic, semiautomatic and manual arc welding where it can do the best job at the lowest overall production cost.

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Depressed Center Wheels

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Simonds also makes Fibrex Wheels, slightly flexible, for the lighter jobs and stainless steel. Also Simex Red Wheels, extra strong for heavy duty use. Send for catalog ESA-244 describing all three.

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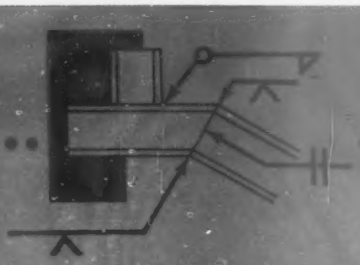

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Hardfacing of worn tractor rails

Question:

Could you give me some information on hardfacing of tractor rails; that is, when to hardface, how much, and what size electrode to use?

Answer:

As normal wear occurs on rails they should be watched closely. When ⅛ to 3/16 in. has been worn away, the tractor rails should be hardfaced, according to Rankin Mfg. Co., who suggest one pass of their Ranite-A hardfacing electrode, an ac/dc type giving 25-30 Rockwell C.

The minimum amount of welding labor is involved at this stage and the one pass will provide a wearing surface to retard future wear.

Maximum recommended height for rebuilding the tractor rails is ¼ in., in which case two passes should be used. However, should a rail be worn down further than ¼ in., no more than two passes are needed.

This amount should raise the working level of the rail to a suitable height. But if the ¼ in. build-up is not sufficient, the rails should be considered beyond practical repair.

When selecting the diameter size of a hardfacing electrode, several factors should be considered: the size of the tractor rail link, the welding procedure to be used, the capacity of the welding machine, and the ability of the weldor to handle the depositing of metal.

Wide links of large tractors will accommodate a 3/16 in. or even a ¼-in.-diameter electrode, whereas the

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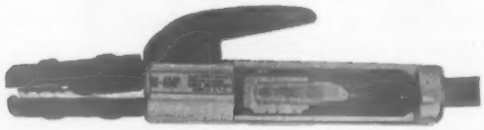
HI-AMP ELECTRODE HOLDERS, CABLE ATTACHMENTS AND GROUND CLAMPS NOW OFFER T.P.C.*



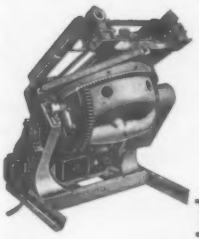
*THREADED POWER CONNECTION uses the pressure of threads on a sleeve to drive the ends of any welding cable down into a welding cable socket, locking it in place with threaded plugs. T.P.C. assures an excellent electrical connection and provides a direct contact between the cable and the accessory so maximum heat is conducted into the heat-absorbing cable. T.P.C. eliminates the loose or oxidized mechanical connections that build up resistance and cause excessive heat in a welding circuit.

Shown in the "cut-away" picture above is an electrode holder with the new HI-AMP T.P.C. connection. T.P.C. can be adapted to ground clamps and quick-disconnect plugs, as well as to electrode holders.

ASK YOUR WELDING SUPPLY HOUSE FOR FURTHER INFORMATION

Write for free "Reducing Welding Costs" booklet

354 W. ADAMS ST. LENCO, INC. JACKSON, MISSOURI



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Ransome Company

SCOTCH PLAINS, New Jersey

RANSOME . . . THE PIONEER IN POSITIONING FOR WELDING

Imagination in concert with engineering are the guideposts of Ransome's design for the future. With 110 years' tradition of craftsmanship behind the company, there are unlimited horizons ahead. In the designer's fertile mind, on the drafting table, in the plant . . . new Ransome products are being developed to keep Ransome a step ahead in welding. *You can expect the new, the different, the better from Ransome;* positioning equipment featuring closer tolerances to turn out more precise and accurate weldments, handle heavier loads and provide more extensive automatic controls. We'd like to apply the new Ransome concept of imagination and engineering to your next positioner or welding automation requirement—please write to see how Ransome can go to work for you.

VISIT OUR BOOTH 400 AT THE WELDING SHOW APRIL 26, 27, 28—LOS ANGELES, CALIFORNIA

smaller tractor links which are much narrower can be handled easily with a 5/32-in. electrode, especially for the border pass.

If a 3/16-in.-diameter electrode is used on narrow rails, however, no fill-in room is left, in which case it would be better to widen the border passes so that they join smoothly to make a finish job without further fill-in.

Regardless of what procedure is used, the width of the pass and the size of the electrode should be altered to cover the surface of the link with a smooth deposit of the proper height.

For a 5/32-in. electrode, 140 to 160 amp is recommended, 175 to 200 amp for 3/16-in. diameters, and 200 to 250 amp for ¼-in. electrodes.

Usually reverse polarity is best to insure proper penetration and utilization of welding heat as preheat. The relatively high welding amperages are desirable to obtain a smooth, even deposit and also to raise the heat level of the parent metal to a point where slow, even cooling rates will be obtained.

If there is any question about the arc characteristics of the electrode, there is a chance that the correct welding machine setting is not being used. If you fail to find a proper setting, have your electrician check the machine. When using a portable welder, make certain that the engine is properly tuned.

Low machine settings will result in cold checks and possible stresses that can cause spalling. A cold stringer deposit, for example, will result in a fast cool, making one section of the link much harder than it should be.

Thus, it will be harder than the center section, where the hotter wash pass permits the weld to cool more slowly, and consequently results in a much softer deposit.

Question:

Do you have any information on the joining of beryllium copper?

Answer:

Beryllium copper can be joined in either of three ways: soft soldering, silver brazing or welding, says Pennrold Div., The Brush Beryllium Co., Reading, Pa.

Soft soldering can be performed following the age hardening treatment without adversely affecting the mechanical properties. Since silver alloy brazing is performed at relatively high temperatures, it must necessarily preclude age hardening.

For either soft soldering or silver brazing, beryllium copper must be free from all traces of oil. Prior to joining, the parts should be cleaned in a 15 to 20% solution of nitric acid in water, followed by a water rinsing.

Standard fluxes can be employed to assure thorough joining and should be removed following the joining of the parts to prevent subsequent oxidation during service life.

Both resistance and inert-gas shielded arc welding are regularly used on formed parts. It is advisable, however, to weld prior to age hardening since, as mentioned above, the high welding temperatures would destroy the age hardened properties of the metal.

The Most Advanced Line of Welding Aids Ever Produced for

PIPE-LAYOUTS of ANY Type or Location

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CONTOUR MARKERS

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

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Really, 5 tools in one—it replaces Protractor, Centering Head, Center Punch, Level and Scale. Eliminates difficult measuring, checking and marking. Pocket size—weight only 9 ozs.

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An easy way to find accurate angles on pipe and structural material. A valuable aid to welders, structural workers and pipe fitters. Size 4" x 8"

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It's flexible . . it's tough

Yes, Belden Welding Cable is "easy on the welder." It's engineered and manufactured to be extremely pliable, limp and flexible. Result: more production . . better quality . . lower costs.

And Belden Welding Cable is rugged . . rough and ready for the most severe conditions of abrasion, impact, as well as exposure to heat, cold, and oil.

Belden has a welding cable engineered for every possible welding requirement . . Oil Tempered Rubber Jacketed . . Neoprene Jacketed . . HVF Vinyl Plastic Jacketed . . Whip Lead, Super-flexible and Neoprene Jacketed . . Neocote colors for identification . . Rubber Jacketed Welder Supply Cords.

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Belden Welding Cable comes in many ready-to-use package lengths.

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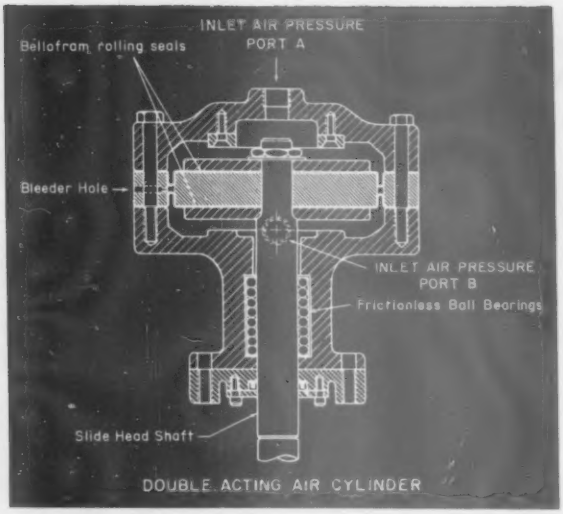


DOUBLE acting air cylinder provides quick response and low friction required for control head of resistance welder.

by **A. B. Palmer**
Bellofram Corp.

Better resistance welds through double acting air cylinder system

IN A RESISTANCE welding operation, a better weld would result if the nugget could be kept under constant pressure during its formation.

This fact has been known for some time. However, the operation requires a force-producing system capable of allowing the two opposed electrodes to move apart when the nugget expands during energy input and contracts on energy removal.

And since these changes in nugget dimensions occur during a short time interval, mass and friction of the electrode system must be as small as possible.

Most resistance welders use an electrode system in which the lower electrode is fixed and the upper one moved by a double acting cylinder. The coupling between the air cylinder piston and the upper electrode is a slide which confines electrode motion to a straight vertical path.

Mass of the moving parts could be reduced to a minimum by use of lightweight metals while still keeping the system structurally adequate. However, the friction problem still remains.

One resistance welder manufacturer had a somewhat more difficult friction problem since most friction was caused by air sealing devices between piston and cylinder walls. In general, better sealing results in increased, undesirable friction. The double acting air cylinder shown above solved the problem.

To provide the quick response and low friction required by the manufacturer for the welder's control head, a double seal configuration was used for the air cylinder. This flexible design permitted control pressure through either of the two ports (A or B) with pneumatic pressure differential supplying the required force to the control head, and to the upper electrode and the work.

The seals or rolling type diaphragms were designed to give maximum flex life under normal operating pressures of approximately 50-60 psi and at operating temperatures of 120 F maximum and 10 F minimum.

Bleeder holes to the atmosphere, located between the seal, maintain a differential pressure across the rolling diaphragms, while the linear configuration of the ball bearings helps ensure positive, fast response to the slide head.

The seal or rolling diaphragm fabrication is simple: a carefully selected fabric is pressure molded into a configuration. The process is controlled so that there is virtually no "vertical give." This resistance to pressure variation permits a long stroke with instantaneous response.

High working pressures can be used in piston cylinder arrangements, since only a small fraction of the applied pressure is experienced as fabric stress. This is due to the narrow convolution inherent with the rolling seal when in the installed and working position.

For example, the space between seal, piston and cylinder (convolution) for an 8-in.-diameter seal is approximately ¼ in. The resulting force from working pressure applied over the convolution area is a small fraction of total working force resulting from pressure applied over the effective piston area.

Bellofram impregnates a fabric with a synthetic rubber compound carefully selected for the proper response and resistance characteristics of the system. Thickness and refinement of the compound are tailored to application requirements, and manufacturing techniques are augmented by specially designed pressure and temperature controls.

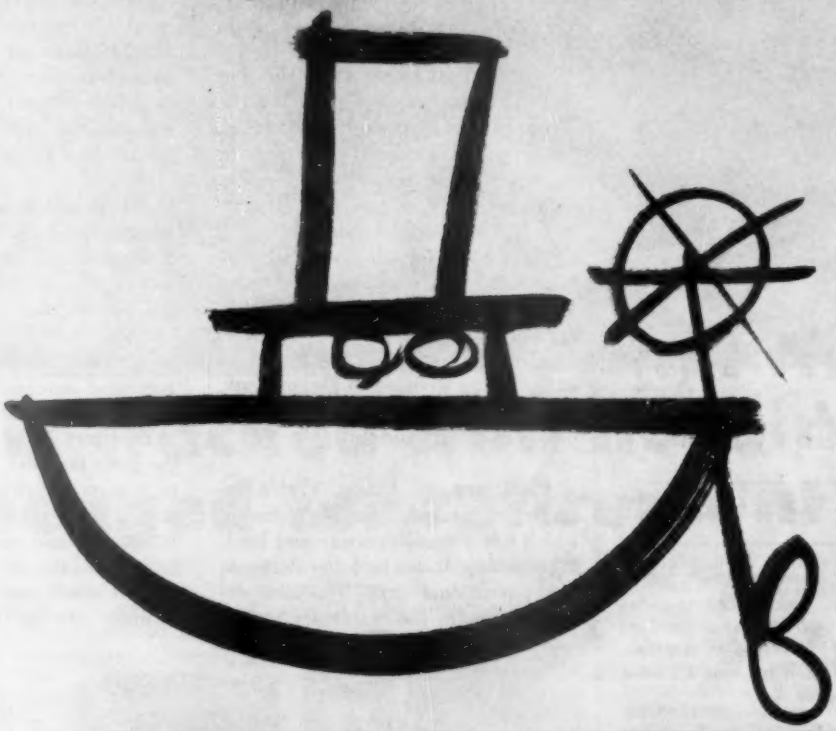
(The particular air cylinder in this application has an 8-in. bore diameter, molded from dacron and impregnated with a synthetic nitrile rubber elastomer, giving a total wall thickness of only 0.30 in.)

The rolling seal requires no lubrication, provides positive leakproof response, and exceeds the service life of many other parts.

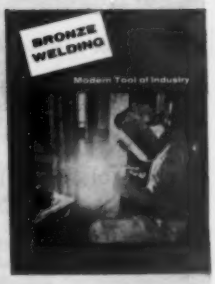
Applied in any design where reliability and instant response are prime design criteria, this rolling seal will inevitably find its way into widespread industrial applications.

BRIDGEPORT WELDING ROD

helps build things...



things like liners and cabin cruisers for ocean voyages and fishing trips. Whatever your application, look for the rod with "Bridgeport" stamped on it! Strict laboratory control assures dependable performance. Every Bridgeport welding alloy tins easily... flows freely and produces dense, sound, non-porous welds of uniformly high strength and ductility plus good machinability. It's available in standard rod sizes and lengths, and coils or spools for automatic equipment. Call your local distributor.



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Specialists in Metals from Aluminum to Zirconium

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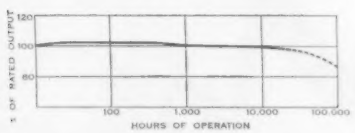

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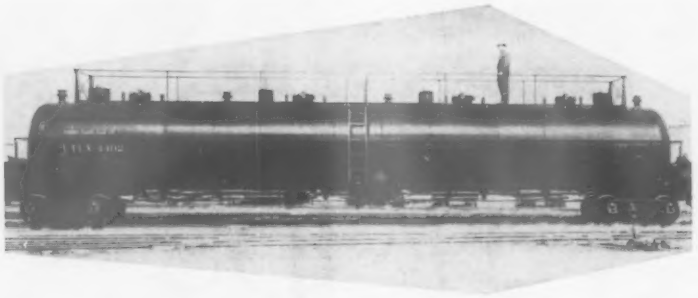


It's big, it's economical, it's welded!!!

Giant railroad tank car has 21,700 gal capacity

SHELL CAPACITY—21,700 gal; length —67½ ft; height—14 ft 8 in.; weight —92,300 lb. empty. These are the dimensions of what are said to be the four largest tank cars in the world.

Union Tank Car Co., Chicago, built the cars and is leasing them to Pennzoil Div., South Penn Oil Co., Oil City, Pa. Pennzoil uses the cars to move oils from its Rouseville, Pa., refineries to its storage and distribution facilities at St. Louis.

Tank cars are of all-welded construction, with each car containing four compartments of 5,425 gal shell capacity each. Fabrication was done by Graver Tank & Mfg Co., East Chicago, Ind., a division of Union Tank, with final construction at the company's Whiting, Ind., plant.

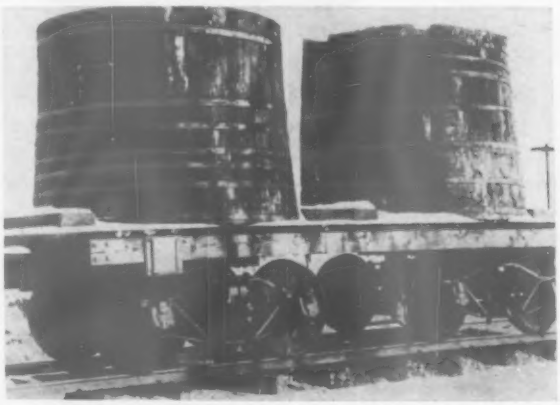
Cars are of Union Tank's recently introduced "hot dog" design, which has a small manway and loading opening instead of the dome as on conventional cars. The new design eliminates the customary underframe by welding the tank directly to short draft sills at both ends of the tank, making it a structural part.

Manual metal arc welding was used on structural members with E6013 electrodes of ¼ and 5/16-in. diameters. One pass was needed on each side. Motor generator sets produced 1,200 amp, d-c. All edges were double-Vee joints with ¼-in. land.

No pre-weld treatment was necessary, but post weld heat of 1,150 F for one hour stress relief was mandatory for Association of American Railroads code.

Submerged arc welding was used to join shell sections. A medium carbon steel automatic welding wire of 5/32-in. diameter was used.

Economy is the main advantage of the giant tank car. It permits the user to transport twice as much product at one time, thus trimming costs. It is cheaper and easier for a railroad to handle one car rather than two. And it costs less for the fabricator to make one car than two.



FIRST railroad tank car (at side) has come long way since its development in 1865, when compared to modern "hot dog" car shown above. First cars consisted of two or three wooden tanks fastened in vertical position on flat car. As capacities increased tanks were placed in horizontal position.

This cracked iron housing begged for retirement

But it was hard for the company to comply when they found a new pump housing would cost $1800, would take 90 days for delivery, and would lay off 40 men during the shutdown.

So they sent it over to Lawton-Schrader, a welding company in Richmond, Virginia to see if it could be repaired. Their weldors said it could be *permanently* repaired with Ni-Rod* "55" Electrodes. And they did it. All it took was 8 hours, 5 passes, and 23 pounds of Ni-Rod "55" Electrodes which also eliminated the need for preheat and postheat.

Back on the job in 1½ days, this pump housing is expected to last till the pump wears out. And the total cost came to $384, a saving of over $1400.

Good to keep in mind and on hand

The example above brings out two good points. One...it's a good idea to keep Ni-Rod "55" in mind for emergency repair of cast iron parts. Two...it's even a better idea to keep a supply on hand to meet these emergencies when they come up.

Ni-Rod "55" makes permanent repairs possible with a minimum of time lost, and with a minimum of effort and money spent. It offers you a practical way to salvage defective castings and to join cast irons to other metals. It's ideal for building up worn or undersized areas. Machinable Ni-Rod "55" deposits give service as good or better than the original metal. And in 9 out of 10 cases, no preheat or postheat is needed.

Booklet gives complete data

"Repair Cast Iron Parts Quickly and Easily" tells the Ni-Rod "55" story in detail. It's yours for the asking. Write:

*Inco trademark

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The International Nickel Company, Inc.
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Which cast iron groove was made in just 42 seconds?

The metal is cast iron. Grinding out the six-inch groove on the right took 5 minutes, 36 seconds. Using the Arcair process, the groove on the left was made in 42 seconds—*eight times faster!*

You can cut, gouge, bevel or groove *any* metal using the Arcair method—and get dramatic cost savings with an investment of much less than $100.

HOW DOES ARCAIR WORK? The torch utilizes air from an 80 p.s.i. air line, current from a welding machine and special electrodes to melt and remove metal. Fifteen minutes instruction is all an operator needs.

WHAT'S YOUR PROBLEM? Write us your specific problem. We'll give you a speedy and sincere answer.

Arcair

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Send me more information on Arcair Torches and special electrodes.

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MY PROBLEM _____

ORANGE peel grab bucket of 1020 carbon steel makes extensive use of welding and hardfacing to counteract impact results.

Welding helps an "orange peel" dig in

BECAUSE OF SEVERE IMPACT, point or tooth breakage is a frequent occurence on grab buckets used to extract crushed rock from canal beds.

Ontario Marine & Dredging Co., Ltd., of Canada has simplified replacement by using Wall Colmonoy Corp's Walmang No. 3 welding electrode to join the point to the "orange peel" grab bucket's body.

The bucket, made of 1020 carbon steel plate, has manganese steel points to resist the severe impact and is being used to deepen the Welland Canal near Thorold, Ontario. It is dropped in 40 ft of water to remove previously blasted rock.

Originally, the firm used 18-8 stainless steel to weld the points, but this was both expensive and time-consuming. In addition, best life with stainless joints was two to three weeks.

The EFeMn-A proved easier and quicker, as well as less expensive. Current used was d-c reverse polarity. The points now last four to six weeks, handling as much as 20,000 tons of rock, a 100% improvement on previous specifications.

Although impact is the major problem, abrasion and wear (as well as breakage) limit point service life. The austenitic manganese steel bucket points work harden to as high as 56 Rockwell C. However, it is possible to further increase point service life by hardfacing.

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Tempilstik°—a simple and accurate means of determining preheating and stress relieving temperatures in welding operations. Widely used in all heat treating—as well as in hundreds of other heat-dependent processes in industry. Available in 80 different temperature ratings from 113°F to 2500°F . . . $2.00 each.

Send for free sample Tempil° Pellets. State temperature desired . . . Sorry, no sample Tempilstiks°

Most industrial and welding supply houses carry Tempilstiks° . . . if yours does not, write for information to:

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Visit our Booth No. 407 Great Western Exhibit Center, Los Angeles, Calif., April 26-28

Medium Frequency (1200 TO 12,000 CYCLES) Induction Heating Equipment for Stress Relieving

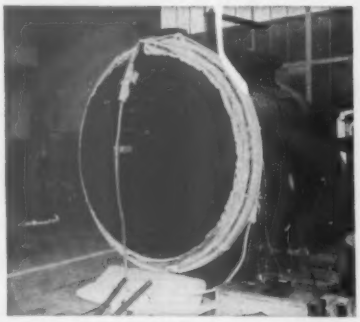
BROWN BOVERI

By Werner K. Haessler, Project Engineer, Brown Boveri Corp.

Brown Boveri manufactures turbine and generator shafts, precision marine gears and other products requiring flawless, stress-free weldments. After thorough testing, the Company adopted medium-frequency induction heating for stress relieving of weldments and for shrink fitting. Compact, mobile power-converters and special heat-resistant, insulated cable were developed . . . adding speed and flexibility to induction heating techniques. Standard sets are now available.

Advantages

Induction heating offers complete mobility not possible with furnaces. Even assembly welds at a customer's plant can be heat-treated. It generates the heat *inside* the metal as compared to furnaces or resistance heaters that heat from the *outside* using high surface temperatures. Thermocouple control allows more accurate adherence to prescribed temperature gradients. Simple cable and insulation arrangements cut labor cost. Cables and work can be covered with asbestos blankets to minimize radiation losses.



Cable arrangement for stress relief treatment of welded flange. Diam. 80", thickness ⅝", max. temp. 1148°F. Maximum power: 60 kw at 2.4 kc/s.

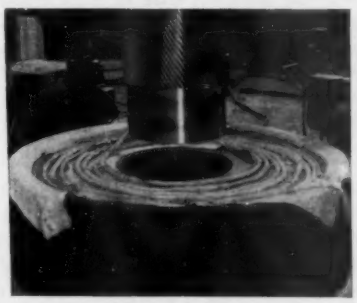
Medium frequency induction heating allows the use of relatively short and light cables with longer cable life. Since only a few turns are required, the energy is concentrated at the welding area allowing substantial power savings. The medium frequency system is adaptable for workpieces from 1/32" thick up to heavy forgings. (Low frequency systems, 50 to 400 cycles, require thick or very long cables and are limited to heating thick, heavy sections.)

Mobile truck for 38 to 110 kw output units. Larger units are also on a mobile chassis. Automatic temperature sequence control. Graph shows record of complete sequence.

Brown Boveri medium frequency converter sets

Frequency kc/s	Power kw	Voltage v	Input* kva
1.2	60	360	90
1.2	110	630	155
1.2	165	720	230
1.2	220	900	300
2.4	50	400	72
2.4	66	540	95
2.4	88	720	127
2.4	130	720	190
2.4	185	900	260
4.8	38	600	60
4.8	55	800	83
4.8	77	540	115
12	44	650	65
12	66	450	95

*3-phase motor input at 220, 440 or 500v, 60c.



Shrinking a gear wheel onto a shaft. The insulating blanket covering the cable has been removed to show the cable arrangement.

All sets are complete on a mobile, 4-wheel chassis. Plug and socket connections are supplied for connecting 2 similar sets in parallel for higher power. Drip-proof housing for outdoor exposure. Power and heat controls provide accurate, automatic heating, soaking and cooling periods with no supervision.

The complete range of Brown Boveri stress relieving units makes it possible to provide the frequency best suited for the specific size, thickness, composition and shape of the workpieces to be treated. In general, the lighter the workpiece, the higher the frequency. Experience has proved, however, that if one machine is to be used for a variety of applications, frequencies in the range of 2 to 2.5 kc are the most suitable.

Upper photo: Cable position during pre-heating at 850°F and welding. Below: Cable windings are simply pushed together and are ready for stress relief treatment up to 1250°F.

Brown Boveri Induction Cable

Highly flexible, heat-resistant. For work temperatures up to 1250°F without water cooling. Can be used for preheating then stress relieving without removal during welding. Bends to radii of 2" or less for easy application to the work. Supplied in easy-to-handle sections of 15 to 50 ft. quickly connected during application. Insulated for 1000v.

Write for complete details and Cost Estimate Questionnaire.

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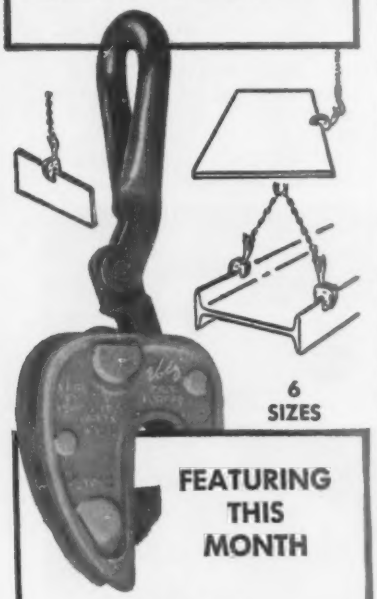

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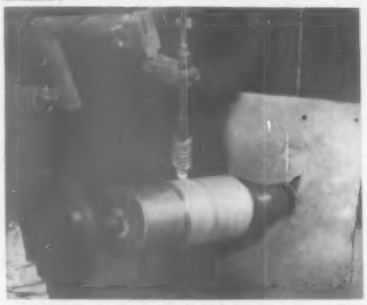
Newer hardfacing method protects surfaces longer

INCREASED SERVICE LIFE up to three times more than that of unprotected parts is the result of a recently developed spray hardfacing method, according to Haynes Stellite Co., New York City.

In a recent application of the company's abrasion- and corrosion-resistant nickel-base alloy powder to pump plungers manufactured by H. L. Dacus Co., Tulsa, the process proved the fastest, most economical way of depositing a thin protective layer.

These pumps handled acids, abrasives, plastics, and cement in oil well servicing operations, the latter including fracturing, cementing, and acidizing.

The alloy powder, which meets specifications for AMS 4775, has a hardness of Rockwell C 62 to 66, and a high degree of corrosion resistance. A finished deposit on a protected plunger is about 0.020-in. thick. Two guns mounted to a vertical track and moving at a predetermined speed provide semiautomatic operation.



SPRAYED deposit is fused to insure a firm bond between deposit and base metal. This multi-orifice oxyacetylene head moves at a carefully controlled speed. Fused plungers are then cooled gradually inside asbestos-lined cylinders

A micro-switch reverses the travel of the guns after each pass has been completed. Powder recovery during spray hardfacing exceeds 90%, further increasing the economy of the operation, according to the firm.

After spraying, the plungers are fused at 1,900-2,000 F in a semiautomatic rig which uses a multi-orifice oxyacetylene head. Fused plungers are given a slow, even cooling inside asbestos-lined cylinders. Finish grinding completes the job.

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Triple-Duty Glass Coated Cover Lens outsell all others on the market because they repel molten weld slag. Will not peel or discolor.

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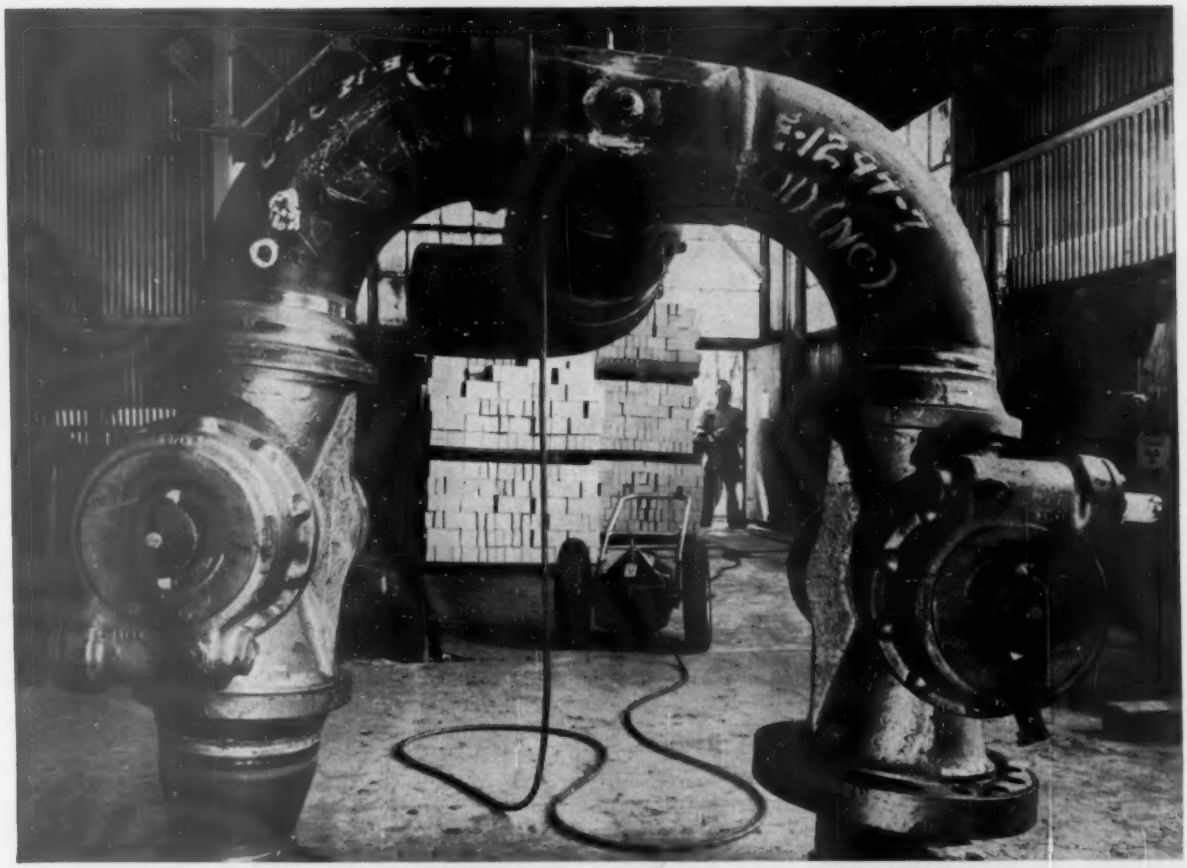

The entire circumference of the left hand weldment at the Tee fitting of this pipe assembly is being radiographed in a single exposure with a Model 50 Multitron. The unit can handle any isotope suitable for gamma radiography . . . and up to four separate sources can be contained in the same machine. A wide variety of exposures can be made—internal, panoramic and beam. Model 50 travels with ease anywhere in plant or field, requires no external power.

VERSATILE! Budd IRIDITRON and MULTITRON units for gamma radiography

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Select the radiography equipment that meets your requirements from the 21 standard Iriditron and Multitron Models now available. One of these models will give you the method or methods of exposure, number of sources, source materials, source strengths, and type of mounting you need. Each model is distinguished by design features that assure you unsurpassed versatility, performance, and safety.

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News shorts . . .

Alloyd Corp., Cambridge, Mass., is moving its research laboratories to new and larger quarters within the city. **United Aircraft Products, Inc.**, Dayton, Ohio, has purchased the assets of **Western Way Welding**, Gardena, Cal. Western Way is now a division of United Aircraft. . . . **General Dynamics Corp.** has leased six floors for a long term in the former Time & Life Building in New York City. The 36-story structure will be renamed the General Dynamics Building when the firm moves in, about Sept. 1.

A fully illuminated, 45-ft structural steel roof sign has been erected at its plant by **Harris Calorific Co.**, Cleveland (see photo). It is visible to the more than 2,500 cars passing by each hour on the city's Memorial Shoreway . . . **Olin Mathieson Chemical Corp.**, New York City, has added to its sheet product line an alumium sheet that is heat-treated to achieve greater strength and hardness.

A seminar in design engineering, aimed at stimulating imaginative and creative thought in design engineering and developing methods and procedures applicable to design projects or systems, will be held June 12 to 17 at **Pennsylvania State University** . . . **Marquette Mfg. Co.**, Minneapolis, has moved its Atlanta warehouse branch to 1468 Southland Circle N.W. to serve its southeastern distributors better.

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. . . the preferred glove among skilled welders

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CHOSEN BY SKILLED WELDERS for extra heat protection, greater finger dexterity, and all-around comfort. Horsehide and "Flextan" leathers stay soft after dry-cleaning. Exposed seams completely welted. Seamless backs.

CHOSEN BY EXPERIENCED BUYERS for soft, sure comfort, longer wearability, excellent price, and quick acceptance in the plant...backed by Riegel's ready service and quick delivery.

COMPLETE LINE for any welding need. Let Riegel's specialists help match the right glove to the job. Ask for free catalog.

HEAVY WELDER No. 997
Top quality green "Flextan", lined for heavy, hot jobs.

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Green "Flextan" leather, excellent protection, flexibility of finger movement.

SPOT WELDER No. 897
For lighter jobs, unlined green "Flextan" leather.

GENUINE HORSEHIDE PALM No. 956
Horsehide Palm, clute pattern cut extra long to prevent wrist chafing, and fourchetted for extra comfort and dexterity. Welted and wool-lined for complete protection.

RIEGEL TEXTILE CORPORATION • Conover, N. C.

This ad, currently appearing in Welding Distributor, tells you another reason why it's good business to do business with your Airco Distributor. He has the latest and best in Airco welding equipment for you . . . and also, he's a solid, reliable, growing member of your business community. You'll find your Airco Distributor listed in the Yellow Pages under Welding Equipment and Supplies.

1960-65 program for new AIRCO DISTRIBUTOR ORGANIZATION promises top growth

In Airco's program for growth, progress plans for Airco Distributors play a key part. Latest news here is the "1960-65 AIRCO DISTRIBUTOR MARKETING PROGRAM."

If you're already an Airco Distributor you'll be getting all details soon.

Briefly, the program spells out additional opportunities through new policy guidance, new sales training, new product development . . . increased participation in the equipment and gas markets and more potential volume for Airco Distributors.

If you're not handling the Airco quality line a prompt inquiry might prove to be the best move you ever made: several territories are now open.

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American Brazing Alloys Co., Pelham, N. Y., has been incorporated and its new name is **American Brazing Alloys Corp.** . . . **Air Reduction Sales Co.**, New York City, will list two separate gas flow ratings—"maximum free flow" and "maximum for conventional applications"—in all its catalog sheets, instruction booklets and descriptive literature. The purpose is to cut down confusion among purchasers resulting from the different methods of rating flows used by manufacturers.

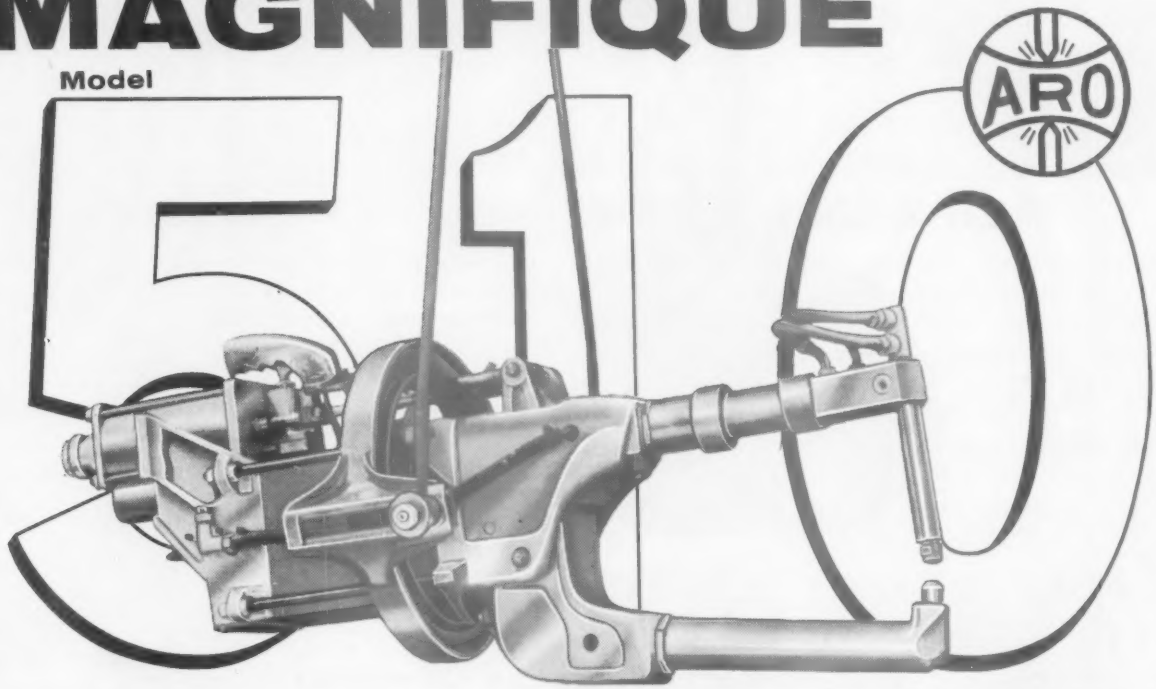
Frank D. McBride, president of **American Solder & Flux Co.**, Philadelphia, is observing his 50th year in business with the firm. . . **Welsh Mfg. Co.**, Providence, R. I., has opened its new southwest warehouse facilities in Dallas. . . Bala Cynwyd, Pa., in the Philadelphia area, is the new location of the northeastern regional office of **National Cylinder Gas Div., Chemetron Corp., Chicago.**

Expansion has caused **Canadian Air Co., Ltd.** and **Canadian Liquidaire Properties, Ltd.**, to move to a new location. As of February 1, the firms have occupied space in the Liquid Air Building in Montreal. . . **Wyzenbeek & Staff, Inc.**, Chicago, has added 6,000 sq ft of space to its flexible shaft equipment and concrete vibrator factory.

Over 10,000 curies of cobalt 60 radioactive isotopes were recently delivered to the French Atomic Energy Commission by the **Budd Co.**, Philadelphia. The isotopes will be used for studies at the French AEC Nuclear Research Center near Paris. . . . **Arcair Co.**, Lancaster, Ohio, has issued a news quarterly to keep its customers abreast of applications, developments, and product developments. . . . A water tank (see photo) in the form of a king-size corned beef hash can is being built by **Chicago Bridge & Iron** for **Libby, McNeill & Libby** in Chicago. Capable of holding 100,000 gal of water, the tank is 130 ft high. (See "pineapple" tank in June, 1959 **WE**, p. 7).

MAGNIFIQUE

Model 510



ARO SPOT WELDER DIV.

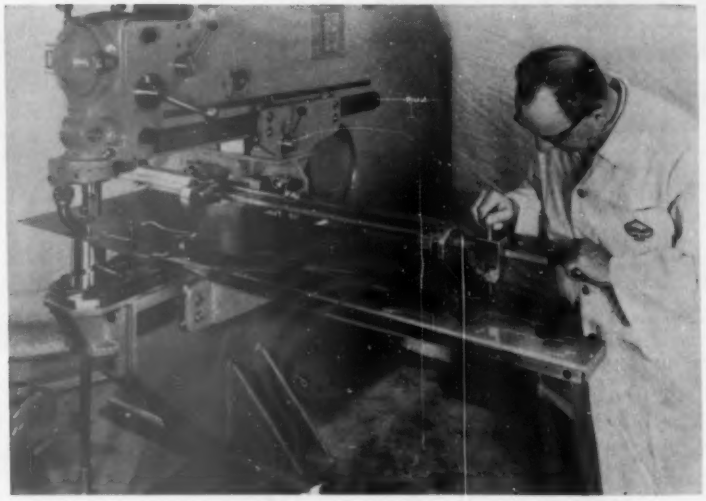
GUTHERY MACHINE TOOL CORPORATION
38-31 CRESCENT STREET LONG ISLAND CITY 1, NEW YORK

18,000 amps • 1350 lbs. pressure • Welds from lightest gauge up to 2x3/16" • Fully automatic • Air Operated • Water cooled

A Wide Variety of Models Available for Every Job
Illustrated Literature on Request
Dealer Inquiries Invited

new products . . .

. . . . use card on page 89



Nibbling machines

Nibbling machines that will reproduce blanks or cut-outs of any shape directly from a master or template are the latest addition to firm's line of shears. New nibblers will also perform beading, folding, flanging, peening and slotting operations. Rectangular cut-outs do not require a master but are positioned directly by built-in rulers. Circular cuts from ⅜-in. to 24-in. diameter can be made by clamping the tracer guiding pin into a revolving, adjustable ruler. Available in throat depths of 41-in., 49-in., and 59-in., nibblers have a cutting capacity of up to 9-gage steel material of 70,000 lb per sq in. tensile strength. *Cosa Corp.*

Circle No. 1

Aluminizing process

New furnace-bond aluminizing process sprays coating on cold by means of mechanical equipment. Aluminum coat is furnace-bonded to base metal at high temperatures in a controlled atmosphere. Total buildup is held within a range of 0.002-in. to 0.005-in. Manufacturer claims more uniform coating in all areas, deeper penetration, greater hardness, and better control of dimensional change due to buildup and growth. *Wall Colmonoy Corp.*

Circle No. 2

Control valves

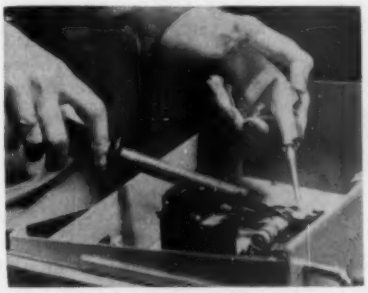
Single and double solenoid plug-in type, pilot-operated, 4-way control valves feature automatic completion of electrical and pneumatic circuits. Incorporating new one-piece solenoid pilot housings, plus aluminum bodies and sub-bases, the valves are said to reduce maintenance time to an absolute minimum. Manufacturer claims extremely fast response for basic ½-in. plug-in valves, due to new short-stroke design. Valve bodies and sub-bases are of heat-treated aluminum alloy, with stainless steel end caps and hard-chrome plated stainless steel stems. Designed for a range of 35-200 psi air service, valves are available with solenoid coils for a-c or d-c, any voltage or cycle. *Valvair Corp.*

Circle No. 3

Welding wire

Automatic welding wires for use with the submerged-arc welding processes are made from selected heats of steel, with analysis controlled to fuse with the parent metal. Wire, available in coils, are low carbon, general mild steel, high tensile steel, highest tensile steel, mild steel killed, general high tensile and medium carbon steel. Coils come in weights of 25/30-lb, 55/65-lb, 70/100-lb, 120- or 180-lb, or in fibreboard drums of 250, 500, or 750 lb. *Air Reduction Co., Inc.*

Circle No. 4



Solder dispenser

Wire solder dispenser is said by manufacturer to offer broad application flexibility to the point of solder, adjust the right amount of solder for each job. Straight or curved probes available in several lengths. Feeds solder wire from .028-in. to .074-in. in diameter. *Products for Industry*

Circle No. 5

The Test Dates on your cylinders are important too. All cylinders made to ICC specifications must be pressure tested at least once in every 5 years except those that are specifically exempted by ICC.

The method of pressure retesting must insure an accurate measurement of the total and permanent expansion of the cylinder.

The IECO Gas Cylinder Testers are water jacket types, using hydrostatic pressure for accurate, safe pressure retesting, a method that is approved by the Interstate Commerce Commission. These testers are available in standard models to fit your requirements.

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IECO **gas cylinder TESTER** *and*

1. Keep your cylinders on the job. Retest between charges.
2. Keep your truck servicing your customers. No trips to Cylinder Testing Laboratories.
3. Keep retesting cost at a minimum.
4. Keep tester busy — Retest for other users.

SEND YOUR INQUIRIES TODAY TO

INDEPENDENT ENGINEERING CO., INC.

O'FALLON 5, ILLINOIS

Power source

New silicon rectifier welder designed specifically as a power source for Nelson stud welding equipment reaches maximum output in less than one cycle and contains no rotating parts other than a motor-driven ventilating fan. Supplied from a 3-phase, 60-cycle, 230- or 460-volt a-c source, the unit provides direct current for welding studs through ⅝-in. diameter to steel or aluminum. Protective devices prevent damage to the diodes if the unit is overloaded by short circuiting or excessive weld times. *Nelson Stud Welding Div., Gregory Industries, Inc. and Westinghouse Electric Corp.*

Circle No. 6

Magnetic separator

Designed for use with automatic and semi-automatic submerged-arc welders, magnetic separator is said to improve welder performance and weld quality by removing from flux contaminating materials accidentally picked up in handling or use. The separator, a funnel used to fill the flux container of the welder, contains three cylindrical alnico magnets. Primarily for use with mild steel and low alloys steel fluxes, the separator is not recommended for working with higher alloys fluxes since it would remove some of the alloy. *Lincoln Electric Co.*

Circle No. 7

Chemical coating

New chemicals, called "Skalix," prevent scale formation on metals during heat treatment. *Navan Products, Inc.*

Circle No. 8

Vertical compressor

Single-stage, vertical compressor has piston displacement from 633 to 1,630 cfm with maximum pressures to 125 psi and horsepower ratings to 150. Model WG-9H increases company's machine sizes to 20, including 5, 7 and 9-in. piston strokes. *Joy Mfg. Co.*

Circle No. 9

Automatic welder

Completely automatic one-side spot and tack welder has syncro-matic positive clutch, heavy duty tripod feeder guide rods, quick change arc nozzle, air cooled heat dispenser. Hand gun is suitable for construction, factory, and maintenance work. *Kras-Lee Equipment Co.*

Circle No. 10

Abrasive belt

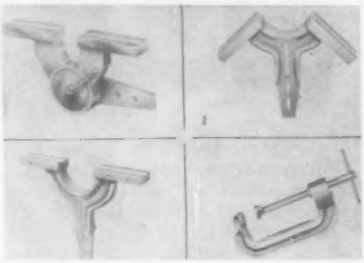
New portable abrasive belt may be hand-held or bench-mounted. Air powered, unit uses a 1-in. x 36-in. belt. Air motor is approximately 1 hp at 6,000 rpm. Belt speed is 4,500 sfpm. Can be used on all materials including ferrous and non-ferrous metals. *Nu-Matic Grinders, Inc.*

Circle No. 11

Work clamps

New line of work holders and clamps is intended for short run welding, soldering and brazing where the cost of permanent jigs is prohibitive. Pieces include adjustable holders, right angle type clamp, and straight type with clamp faces aligned for butt joints. All holders can be combined to make almost any pattern of 2-way or 3-way joints. Holder frames are made of high-strength aluminum alloy for easier handling and faster heat dissipation. Available in both standard and quick-acting types in 3-in., 4-in., and 6-in. capacities. *Wales-Strippit, Inc.*

Circle No. 12



NEW SERIES 45 ULTRA-GRAPH

The Series 45 has an operating radius of 46" when folding arms are fully extended. Within an area of 6500 square inches, parts of almost any design can be cut from steel plate. Circles up to 42" in diameter can be cut, or a straightline cut up to 91" can be made.

In addition a Series 35, Series 59 and Series 89 are available with operating capacities of 35", 60", and 90", respectively. For additional information write for Bulletin 56. See your local Welding Supply Dealer for a demonstration.

The New Heath Ultra-Graph Improves On Normal Flame Cutting Quality

Smoother, cleaner finishes reduce or eliminate additional machining

Erratic movement of the cutting torch as it travels across the surface of metal can produce a cut which is rough and irregular. Often the roughness is an accumulation of burrs and slag which can be removed with a file or grinding wheel. However, irregularities such as undercutting, concentrated metal deposits, and concave or convex surface cannot be removed without changing the dimensions of the part.

Proper control of torch travel speeds can produce the sharp, clean vertical surfaces required for weldment assembly or high finish machining. The new Ultra-Graph machines through the use of an incorporated direct current power supply and transistorized control system make possible the fabrication of complex items such as shown at the left.

Several rack units were fabricated each from 1" x 3" mild steel 20" in length with 19 teeth, which duplicated to close tolerances a machined unit. A three-hose torch was used with oxygen and propane. Setup time was about 10 minutes; actual cutting required 8 minutes. The tooling pattern was flame cut also, and required no additional machining. Total time consumed including initial setup and pattern fabrication was 1 hour 15 minutes. Each additional unit was produced in 20 minutes.

HEATH ENGINEERING COMPANY

168 AULT ROAD
FORT COLLINS, COLORADO

Spike welder

New "spike" welder is capable of 500 welds a minute, plus blemish-free welding of coated metals and ⅛-in. aluminum pieces. Produces 100,000 plus ampere pulses of approximately one millisecond duration, but requires no additional service lines. Manufacturer claims extreme versatility in welding of critical or small parts. *Metal/Craft Co.*

Circle No. 13

Furnace accessories

Six new accessory groups allow one model electric furnace to perform several different operations. They include two stainless steel pots with cover for liquid heating to 1,000 F and 1,600 F, a safety lifting handle for the pots, a perforated stainless steel small parts basket, a perforated skimmer for removing sludge or crust, a graphite melting ladle for use to 1,700 F with no-slip handle, a high temperature refractory chamber liner, and a heavy refractory chamber cover. Furnace is capable of short-run production and heat-treating of small parts. *Thermo Electric Mfg. Co.*

Circle No. 14

Cable connector

Welding cable connector will not overheat or arc, joins securely with a twist of the wrist, manufacturer claims. Molded neoprene covers prevent short circuits and outside arcing, also will not snag, and resist oil and grease damage. Connector is equipped with soft copper sleeves to permit cable attachment by either lead soldering or crimping. Model 120 is available for use with 1/0 and 2/0 cables, and model 340 for use with 3/0 and 4/0 cables. *Ampco Metal, Inc.*

Circle No. 15

Welder/power plant

Driven by a 38-hp, 3-cylinder direct injection diesel engine, DD-250-L d-c welder/a-c power plant is claimed to deliver: two d-c welding ranges; rated output of 250 amp d-c at 40 volts, 100% of duty cycle; maximum open circuit voltage of 65; current adjustment steps—infinite. *Miller Electric Mfg. Co., Inc.*

Circle No. 16

ATLAS | WIDE-BLADE TOMAHAWKS

WORLDS LEADING WELD CLEANING TOOLS

all-metal ATLAS TOMAHAWK *has* "WIDE BLADE", *too!*

They all agree—They get anything and everything they want in an ATLAS TOMAHAWK: Burn-proof, break-proof, shock-proof grip with metal shaft, balance, feel and turn-proof head in the style they want. This is the tool that made ATLAS famous. Everyone likes it—even the man who spends his day on one end of it!

Tough as they come!

33 MODELS

Each Atlas tool is made as well as we know how. Ask your welding supply dealer to show you the complete line.

ATLAS WELDING ACCESSORIES INCORPORATED
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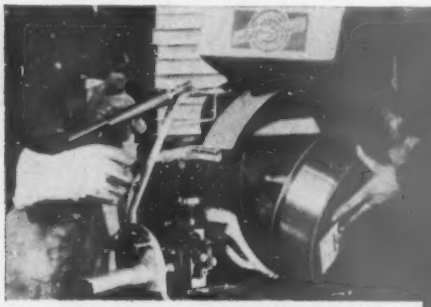
FERNDALE 20, MICH.



Loading 10 lb. spool of #4043 aluminum wire at Michael Flynn Manufacturing Co., Philadelphia. Aluminum in this particular spool was used in welding curtain walls for skyscraper at 2 Broadway, New York City.

now you can get
All-State Spoolarc

SPOOLED ALUMINUM

in all grades, all types
precision layer level
wound on
1 lb. and 10 lb. spools

Wire goes from extrusion and light draw to ALL-STATE'S precision spooling machines where it is layer level wound for smooth, trouble-free welds.

Types available: 1100, 4043, 5052, 5154, 5183, 5356, 5556, 6061, 6063, *355,* 356, 716, 718.

Precision spooled in these sizes: .030, .040, 3/64, 1/16, 3/32, 1/8.
*down to 1/16 only

ALL-STATE *Spoolarc*® spooled aluminum wire meets federal and industry specifications. Spools are sealed in polyethylene bags plus desiccant to retain top quality from spooling machine to welding machine.

Complete stocks available from factories at White Plains, N. Y. and South Gate, California . . . and from branches at St. Louis, Missouri and Toronto, Canada. On sale at over 1000 distributors here and abroad.

Send for new free Aluminum Manual. SEE OUR BOOTH 510 AT THE WELDING SHOW

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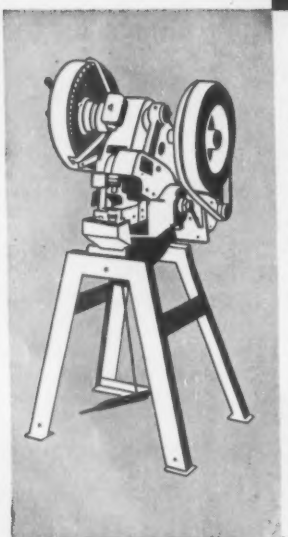
ALL-STATE WELDING ALLOYS CO., INC., White Plains, N. Y.
Call WHite Plains 8-4646 or write for nearest distributor

BATEMAN
BANTAM
IRON WORKER



THE ONLY IRON WORKER OF ITS KIND ON THE MARKET TODAY

No Grinding Necessary After Cut. One Stroke Cycle Clutch Operater by Hand or Foot

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

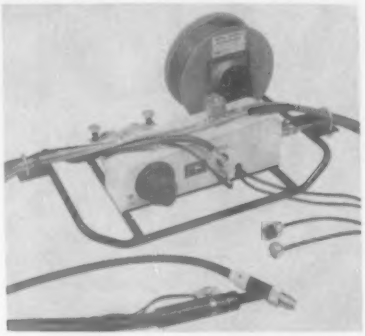
Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

WRITE TODAY for complete information and name of nearest distributor

BATEMAN FOUNDRY & MACHINE
MINERAL WELLS, TEXAS

Control and torch

Arc welding control with wire drive and new torch are designed for consumable electrode processes using shielding gases in making horizontal fillets and flat position welds. Skid-mounted WC-1 control unit,



weighing only 55 lb is designed to avoid intricate electronics. A control motor with a governor replaces electronic components for the wire drive. AM-1 torch has water-cooled cup; all cables and hose, aside from electrode conduit, enter handle at one point. *National Cylinder Gas Div., Chemetron Corp.*

Circle No. 17

Spot welders

New line of resistance spot welders will have advantage of speedy maintenance and repair service, according to manufacturer. *Superior Electronics Service Co., Inc.*

Circle No. 18

Silicon rectifier

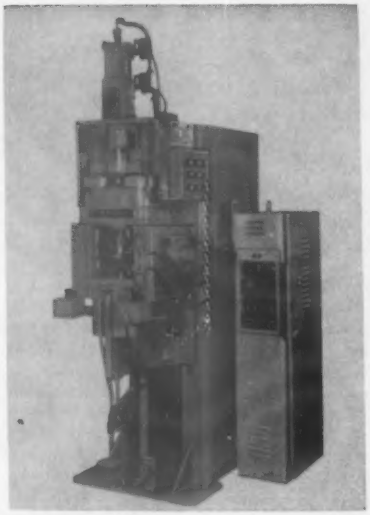
Style 31 double diffused silicon rectifier is rated at 17 amp average at 25 C ambient on a 5-in. x 5-in. x 1/16-in. copper heat sink. Peak inverse voltage range from 50 to 400 volts, in 50-volt steps. *Syntron Co.*

Circle No. 19

Air-cooled welder

Small air-cooled engine welder with engine idler and self-starter are claimed by company to have added convenience and greater economy. Welder will accelerate to operating speed instantaneously when the arc is struck and slow to idling speed 8 to 10 seconds after arc is broken. Changing current is supplied by the generator through a special control circuit. *Lincoln Electric Co.*

Circle No. 20



Force welder

Magnetic force welding machine for making full area percussion welds can be adapted to many operations requiring joining of non-ferrous metals. Designated Model APPAMFP-1-100-12, the unit is a 100 KVA machine with d-c holding coil delayed forge, diaphragm safety head, and selective microswitch firing features. Electronic welding control is fully synchronous with selective half-cycle and positive and negative heat control features. *Arco Welding Mfg. Co.*

Circle No. 21

Toggle clamp

Plunger-type toggle clamp with swivelling handle for use where clearance requirements do not permit using conventionally designed clamps has been added to firm's standard line. Designed for medium-duty applications, device has an overall length of 6½ in. Handle swivels in a 220-deg arc and can be fixed in any position within arc by a lock nut. *Detroit Stamping Co.*

Circle No. 22

Angle lens goggles

Welding goggles feature angled lenses to present wearer with a clear view of the entire work area. A slight tilt of the head gives worker complete view, eliminates blind spots. Also included are comfortable fit, larger spectacles, indirect ventilation, leather nose guard, lightweight construction. Design serves to eliminate neck and shoulder fatigue. *Glendale Optical Co.*

Circle No. 23

Bonding adhesive

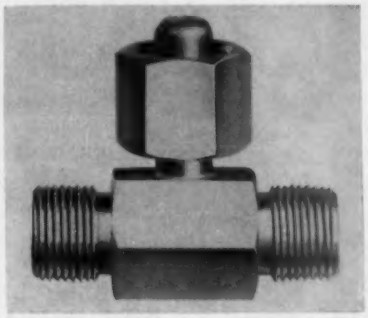
Adhesive adaptable to both sandwich structures and metal-to-metal bonds is a calendered "tape" supplied in 18-in.-wide rolls. At elevated temperatures the adhesive softens and flows. With application of heat and moderate pressure, it cures into high-strength film capable of maintaining bond strength at temperatures to 200 F, according to company. In metal-to-metal bonds, room temperature shear strengths are about 5,000 to 6,000 psi. In sandwich constructions, using aluminum ¼-in. cell size core material, and aluminum skin 0.020-in.-thick, room temperature climbing drum peel strength of core-to-skin bond is 150 lb per 3-in. width. *Narmco Resins & Coatings Co.*

Circle No. 24

Soldering flux

Free-flowing soldering flux is specially compounded for use on all types of stainless steel and non-corrosive alloys. Wetting effect allows any tin-lead solder to flow freely at minimum temperature. Packaged in one-gal polyethylene containers. *American Solder & Flux Co.*

Circle No. 25



Coupler tee

New special brass fitting, an oxygen coupler tee, permits use of two oxygen regulators with one liquid oxygen cylinder, or with pigtail assemblies on manifolding cylinders. *Western Enterprises, Inc.*

Circle No. 26

on "tough" snagging and grinding operations . . .
. . . if PRODUCTIVITY is what you want!
PRODUCTIVITY is what you get!
with the
VEE-ARC
2 HP PORTABLE GRINDER

This **NEW** powerful but light-weight grinder does **MORE WORK** with less operator fatigue . . . **DESIGN-ENGINEERED** for use with **9"** disc wheels . . . can be plugged into nearest 120-v. AC power outlet . . . **LIFE-TIME LUBRICATED** . . . **TAMPER-PROOF SEALED** . . . **SIX MONTHS WARRANTY.** All this . . . and more for only **$168.00** f.o.b. nearest distributor.

Clip Coupon and Mail Today!

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Tell me more about this Vee-Arc Portable Grinder:

Name_____
Firm_____
Address_____
City_____ State_____

POWER . . . PRECISION . . . PERFORMANCE . . . **PRODUCTIVITY**

DOC TUFFY
TO THE RESCUE
REJECTS LIKE CRAZY, JOE! YOU GOTTA DO SUMTHIN'!
THEM REJECTS ARE CAUSIN' ME TH' TORTURES O' HADES, DOC! I'M GOIN' BATS!
SUREST CURE FOR REJECTIVITIS, SIR, IS TUFFALOY COLD-FORMED TIPS. ASK YOUR P.A. TO GET 'EM!
Old-fashioned cast tips laying profits low? Switch to TUFFALOY COLD-FORMED TIPS. You'll get better conductivity, longer life . . . better fusion, fewer rejects.
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C-CLAMPS
. . . with PERMA PAD
. . . punish it!
. . . pound it!
. . . it'll never come off!
NOW! AVAILABLE IN DROP FORGED STEEL
AS WELL AS DUCTILE ALLOY STEEL . . .
CONVENTIONAL AND RAPID ACTING!
NEW! PERMA PADS NOW AVAILABLE
FOR YOUR C CLAMPS . . . ANY MAKE!
ATTACH THIS AD TO YOUR LETTERHEAD AND MAIL TODAY!
Send for Free 52 Page Catalog!
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WILTON TOOL MFG. CO., INC.
WE-30 SCHILLER PARK, ILLINOIS
Sold by leading distributors the world over!

Portable x-ray

Portable industrial x-ray unit is completely self-contained, shockproofed, rayproofed and weatherproofed for outdoor operation. Tube-head weighs 231 lb. and may be hoisted to remote areas for radiography of more than 3 in. of steel. Emergent beam angle is 40 deg and focal spot size is 2.3 mm. X-ray voltage is continuously adjustable under load in a stepless range from 65 to 300 kv. Power requirements are 220 volts, 50/60 cycles, 9 amp. Oil insulated, with inherent filtration equivalent to 4 mm of aluminum, the tube head has a diameter of 9⅜-in. and is 47⅝-in. long, including handles. *Phillips Instruments*

Circle No. 27

High speed saw

New high speed chop or swing-type saw offers powerful 30 hp friction or abrasive cutting and can be used as a grinding wheel. Machine contains sealed-bearing spindle, timing belt drive, and new dynamic suspension system that permits light fingertip feed without springs, counterweights, or adjustment. *Ty-Sa-Man Machine Co.*

Circle No. 28

Control unit

Special control unit for use with torch and welding equipment, contactor interrupts high amperage secondary currents for safety of personnel and equipment. Weighing 40 lb, the unit is 8½-in. wide, 10-in. deep, and 20-in. high. Built to withstand rough use, it is equipped with heavy silver alloy contacts. *Arcair Co.*

Circle No. 29

Flexible grinder

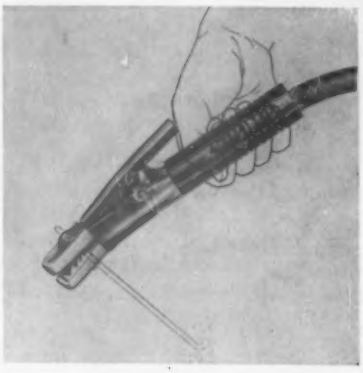
New 1-hp grinder, mounted on a four-leg caster base, has light, welded steel swivel base and handle. Variety of attachments and accessories are available, all equipped with quick-change connectors. *Wyzenbeek & Staff, Inc.*

Circle No. 30

Welding rod

Nickel-silver gas welding rod is capable of joining 14 different metals, and can be used to replace many conventional bronze, steel and cast iron rods in production and maintenance applications where the base metal may be heated to 1,750 deg F, according to manufacturer. Available in 36-in. lengths in 1/16, 3/32, 1/8, 3/16, and 1/4-in. diameters. *Air Reduction Sales Co.*

Circle No. 31



Air-cooled holder

Air-cooled electrode holder for heavy-duty metallic arc welding will hold electrodes through 3/8-in. diameter and is rated 600 amps at 40 volts on 60% duty cycle. Air at low pressure flowing from perforations in the handle cools the holder and the operator's hand. Complete unit includes a 6½-in. neoprene-encased cable whip and a "Y" connection with air inlet brazed into a Cam-Lok twist-and-lock electrical connector. *J. B. Nottingham & Co., Inc.*

Circle No. 32

Cutting machine

Designed for heavy-duty work in metalworking shops, factories, steel mills, foundries, etc. this abrasive cutter has capacity to cut all metals up to 4-in. solids; 5½ in. O.D. pipe or tube; 6 x 1 in. flat stock; 6 in. angle iron; and 8 in. channel iron. Rate of cut is between 2 to 3 seconds per sq in. of metal cut. *American Chain & Cable Co., Inc.*

Circle No. 33

Portable oxygen unit

Capable of providing 7 gallons of pure gaseous oxygen, portable unit is only 11-in. high, 3-in. in diameter, 20-oz in weight. Oxygen is administered by pressing a push button on top of the container. Flow can be administered intermittently or continuously. Units can be stored almost indefinitely without loss of effectiveness. *Linde Co.*

Circle No. 34

NEW PORTABLE SINGER SCREEN

PROTECTION ON ALL 4 SIDES

NOW — a lightweight portable screen designed for complete enclosure. Easy, fast slip-joint assembly (no threads). Rust-proof finish. In 3 curtain materials:

JOHNS-MANVILLE ALUMINIZED ASBESTOS cloth — the last word in protection . . . neoprene-coated FIBER GLASS . . . 12 oz. fire-resistant DUCK. All sizes. Also available in single and three-sided models. Ask your dealer or write us.

16 PAGE CATALOG

Complete line of work gloves, welding gloves and safety clothing.

Special Products Division

SINGER GLOVE MFG. CO.

860 W. Weed St., CHICAGO 22, ILL.

SEE OUR AD IN WELDING DATA BOOK

"DURO is the coolest"*

*says Ben Ruff of Reed & Graham, Inc. "Before I had to change holders whenever the one I was using would get hot. Now, with DURO, I can weld a whole shift without the holder getting hot to my hand, even when using 5/16 in. harfacing electrodes at high amperages."

DURO will do the same for YOU

Proved by 28 years of weldor's preference

- The Duro Electrode Holder has served the welding industry since 1932. It is famous for long life, positive grip and perfect balance. All parts are easily renewed. Semi- or fully insulated. Duro is available in 250, 300, 400, 500 and 600 amperes capacity.
- Cool operation—cool handling. Featuring "Long Jaw Design" for reaching those "hard to get at places."

THE DURO "STANDARD"

- Another feature is the square guard. It protects hands from heat and also prevents rolling and grounding when placed on a flat surface. There when you need it, is a hex key fitted into the brass core and held in place by the fiber handle for making fast cable connections.

DURO ENGINEERING COMPANY

31 OREGON AVE. · HAMDEN, CONN.

About people . . .

Tildesley

Korssell

James M. E. Tildesley has been appointed general manager of Eutectic Welding Alloys Co. of Canada, Ltd., Montreal. In his new position, Tildesley will be responsible for carrying out an extensive expansion program. He was formerly general manager and director of Die Plat, Ltd.

Herbert F. Korssell has been appointed a sales representative for the Plastic Metals division of National-U. S. Radiator Corp., Johnstown, Pa. Korssell will promote the sale of the firm's products in western Indiana, Illinois, Wisconsin, Minnesota, Iowa and Missouri. He will maintain headquarters at the company's branch office at 625 N. Kedzie Ave., Chicago.

Formerly head of research on static electricity at Esso Research and Engineering Co., Linden, N. J., *Dr. Hiram P. Julien* has been named manager of advanced studies department in the technical branch of The Carborundum Co., Niagara Falls, N. Y. A specialist in thermodynamics and molecular structure, Dr. Julien will work in the firm's bonded abrasives division. Five promotions within the company have been announced by the Curtis Machine Division of the company. They are: *Richard D. Rutt* to production manager; *Paul W. Joy* to manager of the technical branch; *Adolph C. Carlson*, to manager of the machine design department; *William C. Keyes* to senior design engineer; and *Francis M. Owrey* to senior quality control engineer.

Recently elected executive vice-president of Metal & Thermit Corp., New York City, was *A. J. Fisher, Jr.* Fisher joined M & T in 1955, and was appointed general sales manager in 1956. In 1958, he was named general manager of the firm's welding products division.

Richard M. Peck has been appointed West Coast district sales manager for The Harris Calorific Co., Cleveland. His duties will include increasing distributor representation in that area and in western Canada. His headquarters will be at Berkeley, Cal.

C. Fred Kober has been appointed as a sales representative by National Electric Welding Machines Co., Bay City, Mich. In this capacity, he will sell special and resistance welding machines to plants in the Saginaw valley and northeastern Michigan.

New sales representatives with Alloy Rods Co., York, Pa. are *James A. Fox* and *Robert G. Rogers*. Fox has been assigned to the Newark sales office to represent the firm in central New Jersey and New York state, and Rogers will cover the San Francisco bay area with headquarters at Emeryville, Cal.

Stewart

Averbeck

Hard Surfacing division of Alloy Rods Co., York Pa., has announced the appointment of *Willard F. Stewart* and *Albert A. Averbeck* as hard-facing specialists. Stewart has been assigned to work with salesmen and distributors in the Pittsburgh office. Averbeck has been given a similar assignment at the Chicago office.

James E. Moore has been appointed as sales and service engineer in the middle Atlantic states by Colmonoy Div., Wall Colmonoy Corp., Detroit. Moore will have offices in the company plant at Morrisville, Pa., and will be responsible for providing hard surfacing application and development engineering assistance to manufacturers and users in that region.

Jack D. Gunther, vice president of Air Reduction Co., Inc., New York City, was recently elected to the board of directors of The Ruberoid Co., New York City. Gunther is also a director of Cumberland Chemical Corp., jointly owned by Air Reduction and Ruberoid.

Samuel O. Jones, consulting engineer at Newport News Shipbuilding and Dry Dock Co., Newport News, Va., has resigned after nearly 45 years with the company. Jones, who was instrumental in the development of procedures which enabled welding to replace riveting in shipbuilding, will be succeeded by welding engineer *Francis V. Daly* and associate welding engineer *R. H. Cunningham*.

Clarence M. Pitts has been elected a director of the board of British Oxygen Canada, Ltd., Toronto. Pitts is a past president of the Compressed Gas Association and the International Acetylene Association.

W. H. (Deak) Atkinson has been named marketing manager of International Rectifier Corp., El Segundo, Cal. Atkinson comes to International Rectifier from Texas Instruments, Inc., Dallas, where he was manager of marketing administration.

Named manager of the process development laboratories of Aluminum Co. of America at New Kensington, Pa., is *J. Howard Dunn*. He has been manager of the company's Cleveland development division.

Newly appointed executive vice-president of Air Reduction Sales Co., New York City, is *C. H. Glasier*. Glasier has been with Airco since 1936 and was until his promotion vice-president of gases.

Bullock

Beane

A new addition to the sales force of Fibre-Metal Products Co., Chester, Pa., is *Joseph T. Bullock*. He will cover Pennsylvania, New Jersey, Delaware, Maryland, and Virginia. Another new member of the Fibre-Metal organization is *Charles Beane*, who will cover New England and New York State territories.

G. E. Tenney, director of services for the Lincoln Electric Co., Cleveland, and a member of its board of directors, retired from the company January 1 after 28 years of service. Tenney plans to do some occasional consulting to parties interested in re-

Farran

Tenney

source development. Replacing Tenney is *John Farran*, who will control the company's service department activities and assume responsibility for expansion of the firm's international field service shop organization.

Dr. T. I. Leston, formerly vice-president in charge of products and research for Eutectic Welding Alloys Corp., Flushing, N. Y., has joined Certanium Alloys and Research Corp., Detroit, as technical director of research.

Standard Steel Corp., Los Angeles, has named vice-president *James E. Cox* as general manager of its Cambridge division in Lowell, Mass. He will now be engaged in the direction of the company's design and manufacture of equipment for transporting, storing and handling low temperature liquefied gases.

Earl A. Erich has been elected vice-president of Tube Turns Plastics, Inc., Louisville, Ky. Erich, who joined the company in 1955 as a piping corrosion specialist, was manager prior to his election.

J. A. Bruce Pinney is assistant chief engineer of Alan Wood Steel Co., Conshohocken, Pa. Pinney will now be responsible for all the company's major expansion projects. In addition, *Elmer V. Eisenberger* has been promoted to electrical engineer from assistant electrical engineer.

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TYPE CB
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TYPE E
Drift and chisel. Shock-absorbent steel handle

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TYPE F
Two chisels at right angles

TYPE FB
Same as Type F except with replaceable brush

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Progressive Welder Sales Co., Pontiac, Mich., has appointed *Henry B. Crutcher* manager of the company's newly expanded Automotive Engineering Division. Crutcher will be in charge of the design, development, and production of the firm's line of automotive welding equipment and custom fixtures.

Louis G. Steffenauer has been appointed sales manager of the K-G Equipment Co., Div., Air Products, Inc., Allentown, Pa. In the new position Steffenauer will be responsible for sales of K-G cutting and welding equipment to distributors throughout the U. S. and Canada.

Died . . .

James I. Banash, consulting engineer for the International Acetylene Association, died on January 10 in Los Angeles. A graduate of Massachusetts Institute of Technology, Mr. Banash was an authority on safety measures concerning compressed gases and was widely known as an author and lecturer on the subject. In 1949 he received the Morehead medal for his contributions to the acetylene industry. He had previously served as president of the National Safety Council.

W. Wallace Roff, 57, vice-president and director of Whittaker, Clark & Daniels Inc., New York City, died of a heart attack on January 16. Mr. Roff started with the firm as an office boy and remained with it for 42 years, during which time he served as sales representative, sales manager, and vice president.

Louis M. Constable, 67, died December 26 at Elizabeth, N. J. Prior to his retirement in 1957, he had been an employee of Linde Co., Div., Union Carbide Corp., New York City, for 51 years. He was an assistant head of product distribution at the Newark office.

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Book Reviews

Electron melting

PROCEEDINGS OF THE FIRST SYMPOSIUM ON ELECTRON BEAM MELTING. Compiled by James S. Hetherington, published by Alloyd Research Corp., Watertown, Mass., 1959. 93 pages.

Compilation of reports dealing with electron beam melting includes such specific topics as apparatus for zone-levelling W-Ta and W-Nb alloys, E-B melting of Ti and Ti alloys, electron bombardment apparatus for zone-melting of tungsten, production of rods from finely divided silicon[28] isotope by E-B melting, conversion of a consumable arc-melting furnace to E-B melting of titanium, and an attempt to zone-melt sapphire by E-B techniques. The papers are written by representatives of such leading corporations as General Electric Co., Bell Telephone Laboratories, Air Reduction Co., Sylvania Research Laboratories, and Westinghouse Electric Corp.

Titanium tubing

GAS-TUNGSTEN-ARC WELDING OF TITANIUM PIPING AND TUBING (AWS D10. 6-59). Prepared by the American Welding Society Committee on Piping and Tubing; published by AWS, New York City, 1959. Price $1.50, 16 pages.

This committee report deals with such topics as power supply, filler metal, joint design, gas shielding, gas nozzles, chamber welding, bend testing, X-ray examination, and titanium grades. Several tables, diagrams and charts included, covering trailing shields for circumferential welds, gas backing and assembly clamping devices, and pipe joint designs.

Comparison charts

FILLER METAL COMPARISON CHARTS (Second Series). Published by The American Welding Society, New York City, 1959. Price $2.50, 48 pages. Booklet contains a complete set of welding rod and electrode comparison charts, including brand names of 78 companies. Fifteen AWS-ASTM specifications are involved and brands as well as manufacturer's names are contained in two indexes.

These charts should prove valuable to all who specify welding materials or are concerned with the identification of brands and classifications of filler materials.

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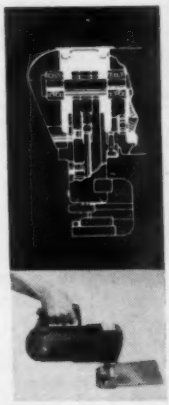

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30 YEARS AGO

(Taken from Welding Engineer of March, 1930)

—30 YEARS AGO—

Among the authors presenting papers at the fourth annual welding conference sponsored by North Texas Agricultural College, Arlington, were G. O. Carter, consulting engineer for Linde Air Products Co.; A. J. Fausek, Modern Engineering Co.; and K. L. Hansen, Northwestern Mfg. Co.

—30 YEARS AGO—

Word from Sam Hord, president of Wichita Falls Oxygen Co., Wichita Falls, Texas, indicates that a new 30-mile pipeline has reached the refinery district in that city. The work was completed in 15 days—an average of two miles of welded pipe per day.

—30 YEARS AGO—

Edward C. Madison, formerly with Wilson Welder & Metals Co., has been appointed vice president of Prest-O-Sales & Service, Inc., Long Island City, N. Y., welding supply distributor.

—30 YEARS AGO—

Frank W. Taft, general manager of Passaic-Bergen Welding Works, Clifton, N. J., informs us that 5,000 copies of a new booklet entitled "Welding An Art" have been distributed by his firm.

—30 YEARS AGO—

To make more secure the confining of prisoners, specifications for the new state jail at Caldwell, N. J., provided that the cells contain no rivets or bolts that can be loosened. Hence, the structure was welded. Contractor was Fries & Son (of Kentucky). Equipment used was manufactured by Electric Arc Cutting & Welding Co., Newark, N. J.

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75. FIREPROOFING—American Institute of Steel Construction, Inc. Color-illustrated, 44-page booklet discusses most modern methods of fire protecting steel. Includes sections on modern building codes, concept of "light-frame" construction, and reference table showing more than 150 fire-resistant constructions and their ratings.

76. HOSE REEL—United Specialties, Inc. Forms EA-102 and OA-100 describe dual reels for ground and welding cable. Specifications on both given.

77. PREHEAT—J. B. Nottingham & Co., Inc. Successful welding of low-alloy high-tensile steel and other alloy steels with the aid of preheat is explained in 40-page booklet. Describes preheating with electric strip heater systems.

78. STRESS RELIEVING—Hobart Bros. Co. Folder DM-117 illustrates and describes the use of portable 400-cycle induction heating equipment for stress relieving welded joints.

79. ULTRASONIC DEGREASER—Princeton Div., Curtiss-Wright Corp. Flysheet discusses ultrasonic degreaser. Features and specifications listed with illustration of purification cycle.

80. GAS CUTTING—Air Reduction Co. Catalog 804L pictures and discusses at length company's Linagraph gas cutting machine. Automatic features and auxiliary parts also considered.

81. CYLINDER CARRIERS—National Cylinder Gas Div., Chemetron Corp. Six gas cylinder carriers are described in bulletin NM-199K.

82. WELDING SCREEN—Singer Glove Mfg. Co. Five-page circular features portable welding screen that encloses job on all four sides. Also shows line of curtains and drapes, asbestos blankets and heavy woolen blankets.

83. CRYOGENIC EQUIPMENT—Standard Steel Corp. Bulletin No. 5913 deals with firm's complete line of cryogenic equipment to store, handle and transport low temperature liquid gases. Two-color publication presents customer stations, bulk storage vessels, truck transports, and low, medium, and high pressure liquid pumps.

84. BACKING RINGS—General Ceramics Corp. Flyer describes firm's ceramic backing rings for use in pipe welding.

85. WELDING HELMET—Sellstrom Mfg. Co. Four-page illustrated catalog 35-H discusses line of fibre glass welding helmets featuring nylon lift front and stationary plate retainers, and new rachet headgear.

86. BRAZING ALLOYS—American Brazing Alloys Corp. Bulletin describes and lists specifications for company's low fuming brazing rod, nickel silver, silver solder, and other brazing alloys.

87. CONTROL DEVICES—General Electric Co. Catalog GEC-1260D contains 72 pages of information on complete line of control devices. Includes horsepower selection charts for variety of motors, complete description of motor starters, contactors, relays, solonoids, limit switches, push buttons, static control and pilot devices.

88. TEMPERATURE INDICATORS—Tempil Corp. Revised brochure 5905 describes and depicts crayon, pellet, and liquid forms of temperature indicating materials and lists their new specifications. Farenheit and Centigrade equivalents table included for convenience.

89. PLASTIC MATERIALS—Devcon Corp. Illustrated 8-page booklet No. 2 describes how large companies effectively utilized firm's line of plastic materials in making jigs, fixtures, metal forming dies, duplicating masters, other tools.

90. WALL CHART—American Brake Shoe Co. "How-to" wall chart in color gives step-by-step instructions for replacing tractor grouser bars, includes detailed ordering information for manganese or carbon steel bars covering all leading makes of tractors.

91. DESIGNER'S GUIDE—Lincoln Electric Co. Bulletin No. 1100.1 contains charts and illustrations providing information on the application of welding symbols and other basic design data on welds.

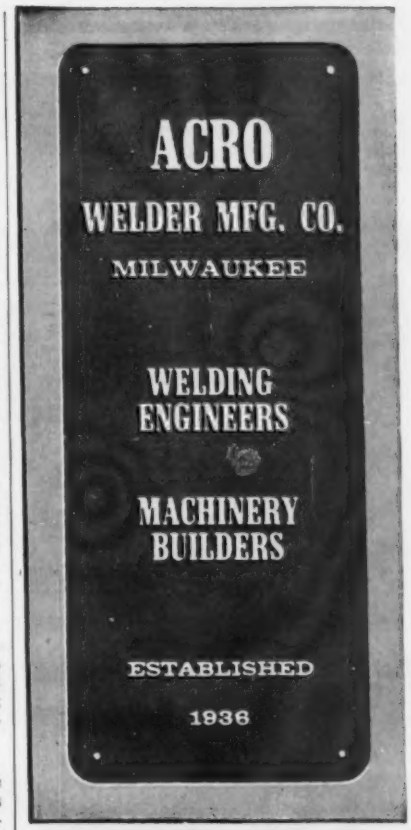
92. INDUCTION BRAZING—Induction Heating Corp. Pamphlet discusses induction brazing and soldering, internal heating applications, includes charts, diagrams.

93. ABRASIVE PERFORMANCE—Wheelabrator Corp. Performance and statistical data compiled in extensive abrasive research and experimentation contained in Bulletin 903-D. Topics discussed include economy in blast cleaning abrasives, how to control finish achieved by airless blast cleaning.

94. AUTOMATIC METHOD—Arcos Corp. Bulletin describes company process for automatically welding girth seams on tanks, contains information on preparing plates, table giving edge preparations, passes, currents, and travel speeds.

95. REFLECTOSCOPE—Sperry Products Co., Div. of Howe Sound Co. Bulletin 50-112 and 50-114 picture and describe applications of ultrasonic reflectoscopes for nondestructive flaw detection; specifications included.

96. BUS DUCT—Westinghouse Electric Corp. Booklet B-7326-380 describes firm's high-frequency bus duct, contains a curve of voltage drop at 400 cycles per second plotted against load.



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97. WET CUTTER—American Chain & Cable Co. Bulletin DH-260-R describes firm's 406 wet abrasive cutter. Standard specifications have been tabulated for quick reference.

98. CONTROL MATERIAL—Eastman Kodak Co. Pamphlet P-36 discusses in detail company's control material for metalworking industries employing etching, photo milling or plating techniques.

99. LOCATING LEAKS—General Electric Co. Four-page bulletin GET-2935 provides detailed information on how to use halogen-sensitive vacuum leak detectors in the laboratory and in production to locate leaks down 1 x 10^{-6} cc per second.

100. SPRAY GUN—Spra Rod Corp. Flysheet describes dual range combination metallizing spray gun.

101. REACTIVE METALS—Pfaudler Permutit Inc. Eight-page bulletin No. 978 describes tantalum, titanium and zirconium in terms of process characteristics, fields of application, and types of standard and custom equipment available.

102. POCKET GUIDE—Air Reduction Co., Inc. New products and engineering data have been added to the most recent edition of firm's pocket guide, a 64-page booklet containing complete information on all types of electrodes.

103. SEMICONDUCTOR AIDS—Anchor Alloys, Inc. Series of aids for those engaged in the design, development, and application of semiconductors are presented in catalog. Data includes high purity, elements, phase diagrams, and "doped" alloys.

104. PROCESSING EQUIPMENT—Pennsalt Chemicals Corp. Company's 15-page booklet describes range of machines, materials and manpower services offered for all types of metal processing.

105. PIPE THAWING—Miller Electric Mfg. Co., Inc. Folder dealing with pipe thawing includes line drawings illustrating detailed instructions on ampere settings, recommended cable sizes, etc.

106. ELECTRODE APPLICATIONS—McKay Co. Eight-page Insert Bulletin A-1 describes successful applications of firm's electrodes and wires in various industry fabrication problems.

107. SCHOOL BULLETIN—Hobart Welding School Bulletin EW-210 contains complete information regarding school applications, curriculum, training methods, specialized courses, etc.

108. RESISTANCE WELDING—Sciaky Bros., Inc. Volume 5, No. 6 of firm's house organ is a 16-page bulletin fully describing a variety of resistance welding case histories, including fabrication of the Juno II missile and the Handley Page Victor bomber.

109. WELD KIT—Arcair Co. Small leaflet contains information on company's weld help kit for use in small jobs or difficult projects.

110. THERMOCOUPLE WIRE—Engelhard Industries, Inc. Data on wide range of noble metal thermoelements included in brochure. Also included are temperature-millivolt curves showing working ranges.

111. BRANCH FITTINGS—H. K. Porter Co., Inc. Sixteen-page booklet illustrates W-S Fishmouth and describes its use.

112. SILVER BRAZING—Handy & Harman Bulletin discusses advantages and importance of silver alloy brazing methods in production of a variety of parts and articles.

113. METAL SPRAY—Metallizing Co. of America. Brochure gives complete information on company's powder jet guns and their various industrial applications, such as metal build-up, repair and salvage of parts and equipment, and ceramic coating.

114. GAS CHART—Ronan & Kunzl, Inc. Wall chart, 8½ x 11 in. shows at a glance gaseous equivalents of one through 5,000 gal of liquid oxygen, nitrogen, and argon.

115. MOUNTED WHEELS—Cincinnati Milling and Grinding Machines, Inc. Folder PG-358 describes features of mounted wheels, contains complete chart showing all standard shapes and sizes of wheels.

116. HEAT TREATING—Pyromet Co. Two-color booklet describes company's facilities for complex brazing and heat treating, includes breakdown of reasons for industry shift to furnace brazing.

117. ALUMINUM ALLOYS—Olin Mathieson Chemical Corp. Booklet of 20 pages contains guides to mechanical finishes of aluminum alloys, with a listing of designations set up by company as well as descriptions of how they are achieved.

118. RADIOGRAPHY—Radiation Engineered Services. Folder describes and lists specifications of gamma radiography equipment for testing welds.

119. INSPECTION METHODS—Air Reduction Co. Eight-page reprint of article from Roads & Streets magazine concerns a guide for inspection methods for welded highway bridges, by La Motte Grover.

120. BRONZE ALLOY—Ampco Metal, Inc. New aluminum bronze alloy that resists stress-corrosion cracking is described in the fourth quarter, 1959 issue of company's Welding News.

121. METAL FILE—Gordon Associates, Inc. Folder describes uses and operating instructions for file to be used on wood, plastics, or stress metals.

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Welding Engineer sought, Engineering Degree required. Opportunity to secure a challenging position with a growing collegiate program in engineering instruction. Interested men are invited to contact the Dean of Engineering, California State Polytechnic College, Pomona, California

WELDING ENGINEER

To develop short range and long term welding processes and guide development of individual qualification and certification tests for proprietary and subcontract products.

Primary experience must be in fusion welding, including manual, submerged arc and inert gas shielded methods. Fundamental knowledge of resistance welding required—experience in spot and flash welding desirable. Will work in carbon and stainless steel, aluminum and super-alloys.

Permanent position with 80 year old nationally known manufacturer of essential equipment for public utilities, industries, transportation and government procurement agencies. Active long range program of adding new products of a specialty nature and improvement of present manufacturing operations. Submit resumes to Personnel Manager.

DRESSER MANUFACTURING DIVISION
BRADFORD, PENNSYLVANIA
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15,000 cu. ft., high pressure, Worthington Air Compressor, complete with 175 H.P. Motor and Electrical Fixtures. Also about $1,500. worth of extra (new) repair parts.

DELTA OXYGEN COMPANY, INC.
611 Court Avenue • Memphis 5, Tenn.

BUSINESS FOR SALE

WELDING SHOP FOR SALE

Completely equipped on main highway 7 miles west of Alpena, Michigan. Shop 40 x 50. Cement block construction. For information write:

NORTHERN WELDING SERVICE
Rural Route 2 Alpena, Michigan

Equipment For Sale

NAME PLATES

Identify your products with stamped name plates showing builder's name, etc. Write for free sample and prices, stating metal desired: Brass, Nickel, Silver or Chrome. Specify width of metal: ⅝", ¾" or 1"

SAFETY TAG COMPANY
Post Office Bldg. Syracuse, Ohio

BENDING SLABS

TWELVE SLABS IN PRIME CONDITION, 4' x 6' x 5" MACHINED ALL SIDES, WITH WINCH AND 3 HP MOTOR—$3,500

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1/8, 5/32, 3/16, ¼, 5/16, ⅜" diam. Airco, G.E., Page, McKay, Smith, Alloy, etc. 500,000 lbs. Types 307, 308, 310, 316, 347 etc. stainless electrodes & wire. Murex arc-oxy CT cutting rod. At LOW, LOW Prices.

LESCO PRODUCTS COMPANY
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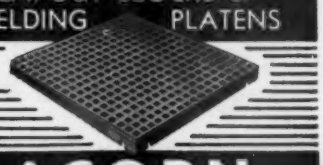
ACORN
LAYOUT BLOCKS or WELDING PLATENS



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"UPGRADE" YOUR WELDING OPERATORS. Send them to Hobart's non-profit welding school. Specialized training for code tests and all phases of welding, manual and automatic. Newest and most completely equipped school in the country. Low tuition. Write Hobart Welding School, Box U-302, Troy, Ohio.

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HEAVY DUTY TURNING ROLLS
for rotating pressure vessels, pipe and cylindrical bodies for welding

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MACHINE CO., ARCADE, N.Y.

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BRONZE—STAINLESS—AMPCOTRODES.
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WELDING EQUIPMENT BOUGHT & SOLD. All Kinds. Submit List and Prices.
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AMBRAZE QUALITY BRAZING ALLOYS

Fully Guaranteed Materials
Meets all Gov't, AWS, ASTM Specifications.

Low Fuming Bronze Rod—
Aluminum—Nickel Silver—
Silver Solder—Flux—
Phos Sil 0,2,6,15 Alloys

Write today for full details

AMERICAN BRAZING ALLOYS CORP.
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SMITH CUTTING TIPS
NEW—GUARANTEED—
ORIGINAL BOXES

Types: LCO-4, LC5-6, LC6-6, Special —**$2.25 ea.** Over 24 pcs.—**1.95 ea.**
National #210 cutting attachment with 3 tips—AA1, AA2, AA3—**$18.50 ea.**

ARC WELDING SUPPLY CO., INC.
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GLENN (M&T) CP WELDING TRANSFORMERS

5—1000 Amp.....$375.00 each
3—1200 Amp.....$475.00 each

For automatic or semi-automatic welding and "Arc-Air" cutting. Never used, still in original shipping crates. Modern 3 phase rectifier type.

BERNARD WELDING EQUIPMENT COMPANY
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Phone — REgent 4-1024

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150. Acro Welder Mfg. Co.—Write for further information on welding machinery engineered and manufactured to order.

151. Air Reduction Sales Co.—Details on how new distributor program will benefit you.

152. Alloy Rods Co.—Additional information on Atom-Arc electrodes available.

153. All-State Welding Alloys Co., Inc.—Manual available on "Spoolarc" spooled aluminum.

154. American Brass Co.—Further information available on "Anaconda" alloys and technical assistance in the selection of the right alloy to meet special problems.

155. American Optical Co.—Data on new AO coverglass goggle.

156. Amerloy, Inc.—Information on alloy wire manufactured by this new organization.

157. Ampco Metal, Inc.—Bulletin W-17 available on "Ampco-Trode" electrodes and wires.

158. Ansco, Div. of General Aniline & Film Corp.—Write for further information on Ansco X-ray films.

159. Arcair Co.—Further information available on Arcair torches and special electrodes.

160. Aro Spot Welder Div., Guthery Machine Tool Corp.—Illustrated literature on the new Model 510 spot welder manufactured by Aro.

161. Atlas Welding Accessories Inc.—Further information available on the Atlas "Wide Blade" tomahawk, and other weld cleaning tools.

162. Bateman Foundry & Machine—Complete information on the "Bantam Iron Worker" and name of your nearest distributor is available.

163. Bernard Welding Equipment Co.—Further information available on Bernard water coolers.

164. Bridgeport Brass Co.—Write for free copy of booklet "Bronze Welding."

166. Brown Boveri Corp.—Details on induction heating equipment for stress relieving and cost estimate questionnaire.

167. Budd Co., Electronic Controls Div.—Complete details available on "Monautronic" control for resistance welding.

168. Budd Co., Nuclear Systems Div.—Write for bulletins on gamma radiography.

169. Chicago Manufacturing & Distributing Co.—Additional information on chipping hammers.

170. Clements Mfg. Co.—Bulletins on "Clements Cadillac Model K Blowtorch."

171. Contour Sales Corp.—Information available on "Curv-O-Mark" pipe-layout tools for marking pipes and structural angle cuts of any type.

172. Duro Engineering Co.—Write for additional information on the Duro electro holders.

173. Eutectic Welding Alloys Corp.—Further information available on the course offered by Eutectic and a manual on "Low Temperature Welding Alloys."

174. Fenway Machine Co., Inc.—Send for complete specifications on the Fenway heavy duty Nibbler for cutting steel easily.

175. Fibre-Metal Products Co.—Bulletin No. 65 on "SuperGrip" electrode holders available.

176. Flood Safety Products Co.—Information available on fiber glass helmets and other welding and safety equipment.

177. Galv-Weld Products—Information and distributor franchises on galvanized welding and samples, are available.

178. Goldsmith Brothers, Div. of National Lead Co.—GB Silver Brazing Data Book available.

179. Harnischfeger Corp.—Bulletin R-29 gives complete information on P&H electrodes, positioners and welders.

180. Haynes Stellite Co.—Information available on mechanized hardfacing with machines manufactured by Haynes.

181. Heath Engineering Co.—Write for details on new models of "Ultra-Graph" flame-cutting machines.

182. Hobart Brothers Co.—More information available on the Hobart rectifier welder.

183. Hobart Brothers Co.—Additional information on two new mild-steel electrodes available.

184. Independent Engineering Co.—Write for information on gas cylinder testers.

185. International Nickel Co.—"Repair Cast Iron Parts Quickly and Easily" tells the Ni-Rod story in detail.

186. Jackson Products—Information on Jackson "Featherlight" holders available.

187. Krembs & Co.—Write for chart and sample of "Fluxine."

188. Lenco, Inc.—Booklet available, "Reducing Welding Costs."

189. Lincoln Electric Co.—Complete details on the ML-3 arc welder and alloy fluxes are available.

190. Linde Co.—Write for Booklet F-1376 on cost-saving applications of "Unionarc (CO_2 magnetic flux) welding.

191. Manhattan Rubber Div.—Further data available on Moldisc depressed-center Type 27 grinding wheel.

219. Merrill Brothers—More than 25 material handling devices are described in catalog C-2, now available.

(Continued on overleaf)

WELDING INFO-AIDS

USE THIS CARD for Literature, Catalogs, and Bulletins shown on preceding pages and for those featured in this month's ads as listed opposite and on following page

Also information about

NEW PRODUCTS described on pages 73 to 79

Every month WELDING ENGINEER lists many new catalogs and bulletins available from manufacturers. All are yours for the asking. However, this service is valuable to you only if you use it.

USE POSTPAID CARD →

★ For copies of any manufacturers bulletins described on these pages circle the number of the items on card at right. Fill in your name, title, company and address. This has to be done only once on either post card. You need no postage.

★ For additional information on New Products described in this issue, circle the numbers of the items that interest you. The New Products section begins on page 73.

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Morton Grove, Ill.

Literature offered in ads . . . continued

192. Miller Electric Mfg. Co., Inc.—For detailed treatment on rectifier stacks, write for free copy of "A New Performance Record in Rectifiers."

193. National Carbide Co.—Write for more data on "more gas per pound" features of calcium carbide.

194. National Cylinder Gas Div.—Six-page bulletin NH 137 gives more information on Dual Shield carbon-dioxide welding.

195. Norton Co.—Further facts on latest progress in weld grinding wheels are available.

196. Page Steel & Wire Div.—Folder DH-402-C contains information on submerged-arc and inert-gas automatic welding wire. Folder DH-1218 lists detailed analyses of Page automatic welding wires, welding rods, etc.

197. Picker X-Ray Corp.—Write for solutions to radiographic inspection problems. Also details of Picker's rental plan.

198. J. M. Ragle Industries, Inc.—Write for more information on Commando drill kit for cleaning tips and other Commando products.

199. Ranking Mfg. Co.—More information available on Ranite hardfacing alloys.

200. Ransome Co.—Write for information on how Ransome "imagin-eering" can go to work for you in automating your production procedures.

201. Riegel Textile Corp.—Free catalog depicts complete line of welding gloves.

202. Simonds Abrasive Co.—Catalog ESA-244 describes three types of depressed-center grinding wheels.

203. Singer Glove Co.—16-page catalog depicts complete line of work gloves, welding gloves and safety clothing.

204. Stoody Co.—Details available on new nickel manganese electrode with iron-powder coating for joining and build-up.

205. Sylvania Electric Products, Inc.—Write for information on various types of tungsten electrodes for Tig welding.

206. Syntron Rectifier Div.—Specifications and other data available on selenium rectifier welding stacks.

207. Tempil Corp.—Sample Tempil pellets available; also information on Tempilstiks—both temperature-indicating devices.

208. Tennessee Fabricating Co.—Write for new catalog on ornamental iron accessories, machine tools and supplies.

209. Thermacote Co.—Data available on Thermo filter plates and cover lenses.

210. John Tillman & Co.—Catalog available depicting weldors' gloves and other safety garments.

211. Trindl Products, Ltd.—Write for full particulars on line of welders, pipe-thawers and accessories. Welder models run from 80 to 400 amp.

212. Tuffaloy Dept.—Catalog and price list on Tuffaloy cold-formed resistance welding tips.

213. Valvair Corp.—Bulletin SVA-5 describes welding gun cap valve which eliminates multiple hoses, excessive air consumption.

214. Vee-Arc Corp.—Further data on 2-hp portable grinder is available.

215. Victor Equipment Co.—Write for more information on Super-Range, a low-cost welding and cutting outfit.

216. Welsh Mfg. Co.—Write for more details on weldors' flash spectacles.

217. Westinghouse Electric Corp.—Pocket-size electrode selector booklet is available.

218. Wilton Tool Mfg. Co., Inc.—52-page catalog depicts C-clamps.

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alloys for outer space

Solving the difficult problem of joining light metals for outer space vehicles is just one of many new uses for TIG welding. And for this kind of critical application, no finer Tungsten Electrode is made than by Sylvania.

Sylvania makes every kind of Tungsten Electrode available: Puretung®, Zirtung®, 1% Thoriated, 2% Thoriated. And each comes in the desired finish—cleaned or ground, and color-coded to save valuable time, prevent costly errors. Chemical & Metallurgical Division, Sylvania Electric Products Inc., Towanda, Pennsylvania.

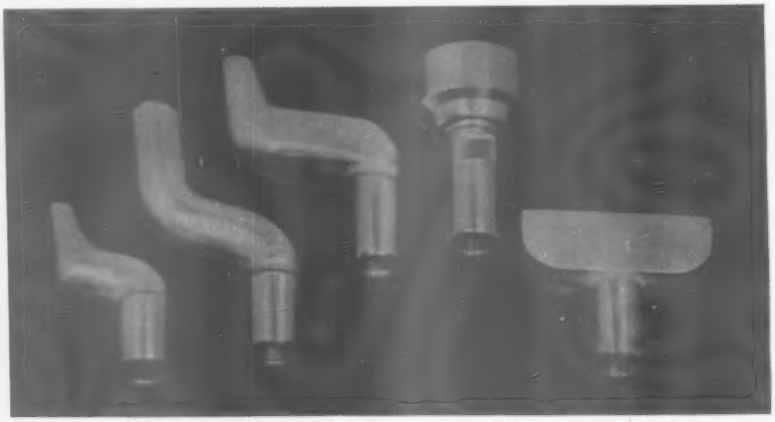
There's a Sylvania Tungsten Electrode for every welding need.

SYLVANIA

Subsidiary of **GENERAL TELEPHONE & ELECTRONICS**

SPOT-WELDING TIPS and

electrodes of Chromium Copper-999 give superior service in high production resistance welding



Acme Electric Welder Co., Los Angeles, a leading resistance welding equipment manufacturer, produces standard spot-welding tips from Chromium Copper-999 rod, seam-welding wheels from Chromium Copper-999 sheet. Irregular shaped tips, above, are Anaconda die-pressed forgings of Chromium Copper. In pieces fabricated from rod, bar, or sheet, strength and hardness are increased by cold working after heat treatment. Anaconda gives forgings an additional cold strike after hot forging to increase surface hardness. *Left:* A forged welding tip in an Acme water-cooled tip holder.

IN resistance welding the electrodes must carry heavy currents under high pressures and at elevated temperatures. They must be made of materials that have high electrical and thermal conductivities and mechanical properties that will keep deformation and wear to a minimum. The widespread and growing use of resistance welding has stimulated research to meet the demand for more efficient and durable electrode materials.

CHROMIUM COPPER-999, one of Anaconda's high-strength, heat-treatable alloys, is an excellent electrode material with a record of superior performance in high-production welding. Electrical and mechanical properties exceed those listed for RWMA Class 2 material. Electrical conductivity is about 80% IACS and thermal conductivity is comparably high. In addition it has tensile strength of about 70,000 psi after heat treatment (compared with 48,000 psi for hard drawn ETP Copper), and its mechanical properties remain high at temperatures approaching 400 C. Available as rod, bar, sheet, tube and die-pressed forgings.

Anaconda also offers Hitenso®-961 as a more economical electrode material for use where service conditions are not severe enough to require the higher properties of Chromium Copper-999. Its properties exceed those of RWMA Class 1 material, having electrical conductivity of about 85% and tensile strength of about 60,000 psi. Available as rod, bar and plate.

TECHNICAL ASSISTANCE. For further information on these Anaconda alloys or for technical assistance in the selection of the right alloy to meet special problems, see your American Brass Company representative. Or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5981

RESISTANCE WELDING ELECTRODE MATERIALS
ELECTRICAL COPPERS • WELDING RODS

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